

2022 CTDOT Service and Fare Equity Analysis

Connecticut Department of Transportation

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Service and Fare Equity Analysis Executive Summary

In accordance with Title VI of the Civil Rights Act of 1964 and Federal Transit Administration (FTA) Title VI Circular 4702.1B, Connecticut Department of Transportation (CTDOT) conducts a Service and Fare Equity (SAFE) Analysis any time fare changes or major service changes are proposed to ensure that changes do not unfairly impact minority and low-income populations, as defined by the FTA Title VI Circular.

CTDOT is analyzing proposed changes to service on the Waterbury Line and providing fare discounts on *CTrail* ten-trip tickets. In addition, CTDOT is analyzing proposed service changes to *CTtransit* bus service.

Equity Analysis Methodology

The CTDOT FTA Title VI Program outlines the agency's Major Service Change, Disparate Impact, and Disproportionate Burden policies, as well as the way in which CTDOT conducts SAFE Analyses. Rail major service and fare changes, and proposed bus major service changes were analyzed to determine if there are disparate impacts to minority populations, or disproportionate burdens to low income populations.

Proposed Connecticut Rail System Changes

In response to public officials' requests, seven additional weekday trains are proposed to be added to the 2022 Waterbury Line schedule to provide 22 daily trains compared to 15 daily trains today. This service increase was made possible by the installation of passing sidings and a Positive Train Control (PTC) train signal system. The proposed changes affect the Waterbury Line schedule as follows:

- During the AM and PM peak periods, train service will be increased by 50% while reducing headways, primarily in the northbound direction, compared to the current schedule.
- In the mid-day Off-Peak period, service will be increased by 33% - 50% while headways are reduced by over 30%, compared to the current schedule.
- These proposed changes include the absence of three Monday-Friday stops at Stratford Station during the AM Peak, PM Peak, and midday and PM Off-Peak periods. These are the only service reductions associated with 2022 Waterbury Line schedule.
- A new early morning southbound train to New York, via connecting train, is proposed.

In addition to schedule changes to the Waterbury Line, to help promote train ridership and to better align with the discount program available on the New Haven Line (Metro-North), CTDOT is proposing to increase the discount on the already discounted Hartford Line and Shore Line East 10-trip tickets, from ten trips for the price of nine to ten trips to the price of eight. This equates to an additional 11.1% discount on top of the already discounted 10 trip-ticket.

Proposed CTtransit Bus System Changes

The purpose of the proposed changes to CTtransit bus routes are to allow for better coordination with CTrail Hartford Line trains, to convert two pilot bus routes into permanent routes and to introduce a new Express bus route.

Hartford Bus System

The following changes are proposed for bus routes operating in the Hartford region:

- On Route 24 (Windsor-Bradley International Airport-Windsor Locks) and Route 512 (Berlin Turnpike) schedule changes would allow for better connections with CTrail Hartford Line trains.
- Route 940 (Waterbury-Meriden) is a pilot route designed to provide a direct route between Waterbury and Meriden and to strengthen connections to train arrivals/departures at the Waterbury and Meriden stations. It is proposed to make it into a permanent route.
- The Bradley-Union Connector is new proposed route which will provide express service between Bradley International Airport and Hartford Union Station.

New Haven Bus System

The following change is proposed for the New Haven region:

- Route 282 (East Grand Avenue Bus Bridge) began service as a temporary bus route in response to the Grand Avenue Bridge construction project. The route proved to become one of the most efficient routes in the New Haven bus system. It is proposed to make it into a permanent route.

Service and Fare Analyses – Findings and Alternatives

Rail System Findings

Analyses of the rail major service changes on the Waterbury Line and CTrail fare changes are presented as follows:

- General – The 7-train service expansion is a massive 47% service improvement and benefit to the people of the Naugatuck Valley and the Waterbury Line.
- Headway changes - No disparate impacts or disproportionate burdens were identified.
- Stop changes – No disparate impacts or disproportionate burdens were noted to Waterbury Line stations, however, because several Waterbury trains now also stop on the main line at Stratford, it is included as a consideration. A technical disparate impact and a disproportionate burden was identified because the proposed Summer 2022 Waterbury train schedule has no stops at Stratford Station (a minority serving station).
- Fare Changes – No disparate impacts or disproportionate burdens were identified.

Rail System Mitigation Alternatives

For Waterbury Line, the project team observed the presence of substitute Greater Bridgeport Transit (GBT) bus route 23 for connection of the line to/from Stratford, with broader travel choices to Peak and Off-Peak trains. The team recommends that the Derby-Stratford bus connections be considered as an offset to the disparate impact from the absence of the three rail stops.

With the proposed large-scale service expansion, multiple trains passing are being introduced, along with a new signal system. This poses a cautionary note in adding stops to this untested train schedule.

However, the team identified - subject to operational viability - three possible rail stop measures:

- Monitor Ridership – Adjust service according to observable ridership changes
- Remediation – Adjust the schedule to remove the quantified impact. This could be accomplished by:
 - Retaining similar stops on three trains in the Waterbury Summer 2022 schedule. While this would not fully compensate for the disparate and disproportionate impacts, it would serve to reduce the 15% threshold variance.
 - Another remediation step could be to add a Stratford stop in the AM Off-Peak time period to eliminate the disparate/disproportionate variance finding.
- Restore and add Stratford Station stops to the 2022 Summer Waterbury Line schedule. This would ensure all Waterbury Line stations receive the benefits of expanded service equally.

Bus System Findings

The proposed service changes for CT*transit* Route 24 resulted in a disparate impact to minority populations.

Bus System Mitigation Alternatives

The increase in service frequency change on Route 24 triggers a disparate impact as that route is slightly non-minority favoring. However, this is a change that benefits both minority and non-minority riders on the route by providing them with more frequent service.

Introduction

Title VI of the Civil Rights Act of 1964 ensures that “no person in the United States shall, on the basis of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.” The Connecticut Department of Transportation (CTDOT) has committed to the Federal Transit Administration (FTA) Title VI objectives set forth in FTA Circular 4702.1B ensuring that FTA-assisted benefits and related services are made available and are equitably distributed without regard to race, color, or national origin.

The FTA requires recipients of transit program funds, including CTDOT, to “evaluate significant system-wide service changes and proposed improvements at the planning and programming stages to determine whether those changes have a discriminatory impact.”

Proposed changes for rail include increased service on the Waterbury Line and discounts on *CTrail* ten trip tickets. Proposed changes for bus service include extra trips on *CTtransit* Hartford area routes, 512 (Berlin Turnpike) and 24 (Windsor-Bradley Int'l Airport-Windsor Locks). Proposed new bus services include *CTtransit* New Haven area Route 282 (East Grand Avenue), *CTtransit* Express Route 940 (Waterbury-Meriden) and a *CTtransit* Hartford area route, the Bradley-Union Connector.

Title VI Principles and Definitions

CTDOT’s FTA Title VI Program for FFY 2021 – FFY 2023 defines its Major Service Change Policy as any service change meeting at least one of the following criteria:

- Route restructuring actions resulting in at least a 20% change in overall route length.
- Service frequency changes that result in a 25% or more change in annual revenue vehicle miles (RVM). Annual RVMs are a compilation of weekday and weekend RVMs.
- A service change adding or reducing service to a fixed guideway station resulting in a greater than 25% change in service at the station.
- Service change actions resulting in at least a one-hour change in service span.

Service Equity Analysis Policy

A Service Equity Analysis will be conducted whenever CTDOT proposes a major service change to the rail or bus system as defined in the policies provided above; providing these changes will remain in effect in excess of twelve (12) months. When a service change is proposed, there shall be a twelve-month look-back, to determine if the aggregate of any changes in the prior twelve (12) months would have triggered one of the major service change criteria. The following service changes are exempted:

- Standard seasonal variations in service: a seasonal route or routing variation is usually a modification to service to provide “added” access that is not broadly needed year-round, or the discontinuation of the same. Any temporary service addition, change, or discontinuation of a route with the intention that it will be in operation for less than twelve months is also

exempted. While all changes from regular service to seasonal service and the reverse are exempt, should there be changes within the seasonal service from one year to the next, CTDOT will conduct a Service and Fare Equity analysis should the change exceed fifty percent (50%), regardless of increase or decrease in service;

- Changes on routes serving sporting events, special events, or service contracted through other cities or agencies;
- Any service change that does not meet the definition of a major service change such as minor route alignments, frequency, span, or time point adjustments; route or bus stop changes due to temporary road detours caused by construction, maintenance, closures, emergencies, labor disruptions or strikes, fuel shortages, or safety concerns; etc.

Fare Equity Analysis Policy

A fare equity analysis will be conducted whenever CTDOT proposes a fare change, regardless of the amount of increase or decrease. For proposed fare changes CTDOT will:

1. Determine the number and percent of users of each fare media proposed for increase or decrease;
2. Review fares before the change and after the change;
3. Analyze the fare media generated from ridership surveys indicating whether minority and/or low-income riders are disproportionately more likely to use the mode of service, payment type, or fare media proposed for change; and
4. Compare the impacts for each fare media between minority users and overall users.

A fare change is defined as an increase or decrease in fares: (a) on the entire system, (b) on certain transit modes, or (c) by fare payment type or fare media. The exceptions are as follows:

1. “Spare the air days” or other instances when a local municipality, the State or CTDOT has declared that all passengers ride free;
2. Temporary fare reductions that are mitigating measures for other actions (i.e., construction activities that close a segment of the rail system for a period of time); or
3. Promotional fare reductions that last less than six (6) months.
4. FTA Circular 4702.1B states that a recipient can implement a fare increase that would have a disproportionate or adverse effect provided that it demonstrates the action meets a substantial need that is in the public interest, and that alternatives would have more severe adverse effects than the preferred alternative.

Disparate Impact/Disproportionate Burden Policy

The purpose of the SAFE Policy is to establish thresholds which identifies when adverse effects of a major service or fare change result in a disparate impact to minority populations, or a disproportionate burden to low income populations.

CTDOT applies the Disparate Impact Policy and the Disproportionate Burden Policy uniformly to all major service and fare changes regardless of mode.

Major Service Changes

A major service change to the rail or bus system will be deemed to have a disparate impact on minority populations, or a disproportionate burden on low income populations, if the percentage of riders or vehicle revenue hours on affected minority-classified or low-income classified routes is at least fifteen (15%) percent higher than the percentage of riders or vehicle revenue hours on non-minority-classified or non-low income classified routes affected by the major service change.

Fare Changes

A fare change will be deemed to have a disparate impact on minority populations or a disproportionate burden on low income populations if its implementation results in either:

1. When one fare change is proposed, the percentage of impacts of the proposed fare change borne by minority or low-income riders as a result of the proposed fare change is at least ten (10%) percentage points higher than the percentage of impacts of that proposed fare change on the overall rider population; or
2. When more than one fare change is proposed:
 - For each fare change in the package: the percentage of impacts of each individual proposed fare change borne by minority or low-income riders as a result of the proposed fare change is at least ten (10%) percentage points higher than the percentage of impacts of that proposed fare change on the overall rider population; and
 - For the total package of fare changes: the aggregate percentage of impacts for the proposed fare changes borne by minority or low-income riders as a result of the proposed fare changes is at least five (5%) percentage points higher than the aggregate percentage of impacts on the overall rider population.

FTA Circular 4702.1B states that a recipient can implement a fare change that would have a disproportionate or adverse effect provided that it demonstrates the action meets a substantial need that is in the public's interest and that alternatives would have more severe adverse effects than the preferred alternative.

Rail

Connecticut Rail System Description

Passenger rail service in Connecticut is supported by CTDOT and consists of three main lines and three branch lines.

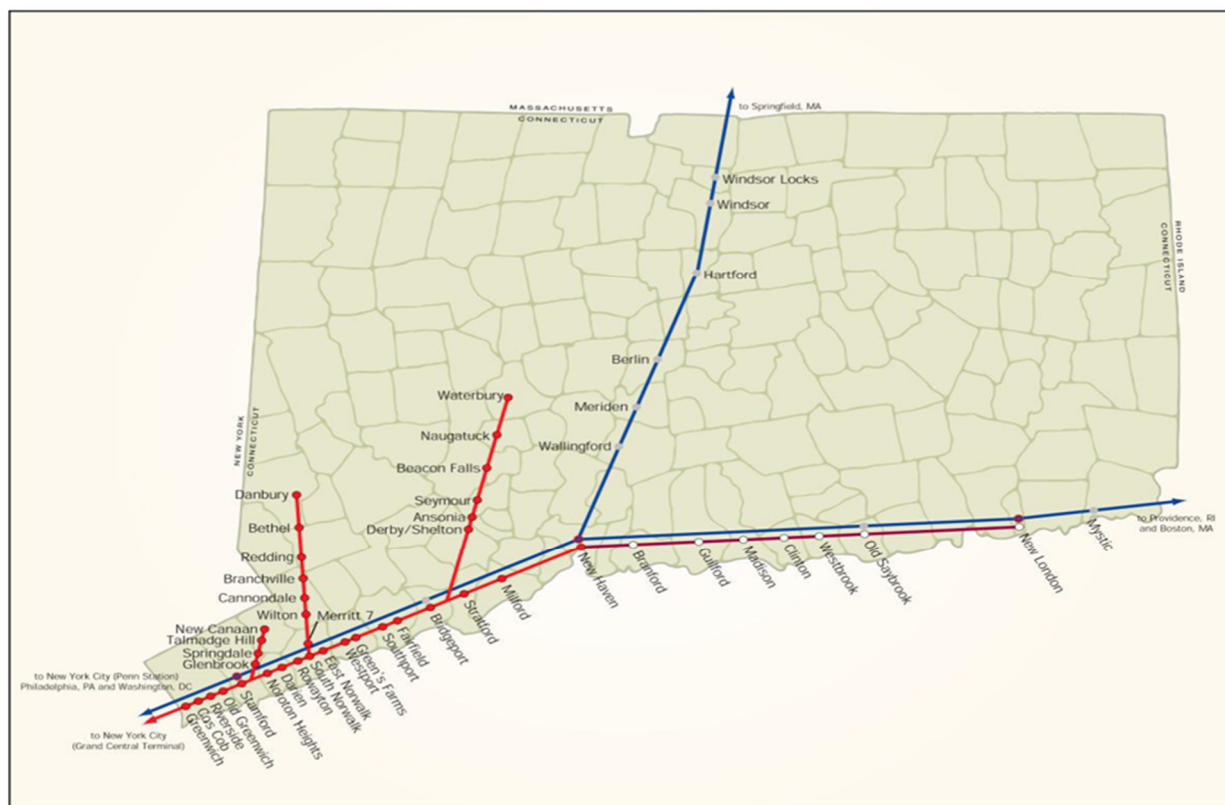


Figure 1 - Map of Connecticut Rail Passenger Service

The New Haven Line, operated by Metro-North Railroad (Metro-North), operates between New Haven and Grand Central Terminal in New York City. This line has three branch lines that extend to New Canaan, Danbury and Waterbury. *Illustrated by Red lines on Figure 1.*

Shore Line East (SLE), operated by Amtrak, operates along the Northeast Corridor between New London and New Haven, with some through service to Stamford and connections to the New Haven Line. *Illustrated by Purple line on Figure 1.*

Amtrak and TransitAmerica Services Inc. (TASI) operate intercity passenger services between New Haven – Springfield (Hartford Line), and Amtrak over the Northeast Corridor to New York. *Illustrated by Blue lines on Figure 1.*

2022 Rail Service Changes

Rail Lines Major Service Change Analysis

The 2021-2023 CTDOT Title VI Program defines a major service change as any service change meeting at least one of the following criteria:

- *Route restructuring actions resulting in at least a 20% change in overall route length.*
- *Service frequency changes that results in a 25% or more change in annual revenue vehicle miles (RVM). Annual RVMs are a compilation of weekday and weekend RVMs.*
- *A service change adding or reducing service to a fixed guideway station resulting in a greater than 25% change in service at the station.*
- *Service change actions resulting in at least a one-hour change in service span.*

The threshold analysis compares the August 29, 2021 service characteristics to the proposed 2022 service characteristics, both in threshold analysis, and in the breakdown of service levels for those major service and fare changes.

Since the only significant service changes are slated for the Waterbury Line, an analysis was performed to identify if those changes qualified as a major service change as defined by the CTDOT major service change policy. **Appendix A** contains the details of these analyses.

- **NHL Waterbury Line – Major Service Change**
 - The Waterbury Line service was re-slotted in the process of adding 7 additional trains, which represented service increases to station service, train and vehicle-mile frequency compared to existing weekday service.
 - Service frequency on the Waterbury Line exceeded the 25% threshold change in stops, headways, and service RVMs Southward and Northward weekdays.
 - Train and vehicle-mile frequency 2022 compared to 2021 considered a major service change, exceed the 25% threshold. The Waterbury Line also received service span increases of 59-minutes Southward; and 1-hour, 53-minutes Northward classifying as major service span increases weekdays.

Rail Major Service Change Summary

An overview of the service changes across the entire Waterbury Line service is shown below, following the convention of prior SAFE analyses. The table below shows a summary of the rail threshold analysis for Waterbury service changes, which only affected weekday (Monday-Friday) train service.

Table 1 – Waterbury Line Service Change Threshold Analysis

TITLE VI	Service Changes			
Waterbury	M-F	Sat	Sun	Per Week
August 2021	15	12	12	99
Summer 2022	22	12	12	134
Change (-)	47%	0%	0%	35%

Peak vs. Off-Peak Breakdown

For the individual travel time periods, the analysis indicated the following:

- For 2022, the Peaks receive 50% increases in service while reducing headways, chiefly Northward over 2021 service.
- For 2022, the mid-day Off-Peak receive 33%-50% more service while also reducing headways by over 30% over 2021 service.
- The absence of the three (3) Stratford stops – each in the AM Peak, PM Peak, PM Off-Peak are the only service reductions associated with this 2022 schedule.
- The introduction of an early Waterbury Southward departure weekdays is a new train that arrives New York via connecting train, before 6:00 a.m., representing a 100% increase to the AM Off-Peak (pre-AM Peak) time period.

Please refer to **Appendix B** for the detailed breakdown of these factors by station.

Rail Service Equity Analysis

Methodology

As part of its Title VI Program, CTDOT recently completed a demographic analysis of rail service territories on the New Haven Line, three branch lines including the Waterbury Line, and Shore Line East and classified minority and low-income stations on each line. According to CTDOT's Title VI Program, rail service territories are each defined as all census tracts that are within (and touching) 2.5 miles of the commuter rail stations. Census 2013-2017 American Community Survey (ACS) data was utilized in the analysis.

For consistency with CTDOT's current Title VI program, the minority and low-income station classifications and the 2013-2017 ACS data was utilized in the project team's rail service equity analysis. CTDOT's Title VI Disparate and Disproportionate burden threshold of 15% (described above under Title VI Principles and Definitions section) was used to determine whether a disparate impact or disproportionate burden exists for major service changes.

As discussed above, changes on the Waterbury line resulted in a major service change. The project team evaluated schedule changes in terms of station service (i.e. station stop differentials) and degree of service (i.e., station weekday headway differentials (peak and off-peak)). 2021 rail schedules were compared to current 2022 schedules to determine average stops and headways per station in the peaks and off-peaks for both directions of rail service. Average stop reduction and average headway increase was then calculated for each station in each of periods. **Appendix B** contains the Service Change Analysis tables.

The project team then compared average stop change and average headway change between minority-serving and non-minority-serving stations to determine if disparate impacts exist in service; and between low-income-serving and non-low-income-serving stations to determine if disproportionate burdens exist. Using the 15% threshold, if the service changes for minority serving stations was more than 15% worse than the changes for non-minority serving stations, that would

signify a disparate impact. Similarly, if changes for low-income serving stations are more than 15% worse than non-low-income serving stations, that would signify a disproportionate burden.

The project team also calculated the aggregate minority and low-income populations of the service territories of each rail line that had a major service change and compared to the minority and low-income populations of CTDOT's total rail system (including the Hartford Line) service territories in aggregate. To determine minority and low-income status, two Census ACS tables were utilized.

- Table B03002 (Hispanic or Latino Origin by Race) which contains population counts by race broken down by Hispanic or Latino origin. Minority population counts were calculated as total population minus counts for "not Hispanic or Latino" variable (one race: white alone).
- Table B06012 (Place of Birth by Poverty Status in the Past 12 Months in the United States) which reports poverty status by place of birth. Low-income population counts are those who live below 150% of the poverty level (which is consistent with CTDOT's Title VI policy).

The purpose of this aggregate exercise was to confirm that for lines where major service changes occurred, that none of the lines' minority or low-income populations exceeded the total rail system minority or low-income service territory population by greater than 15%. The results of the Rail Service Equity Analysis are presented below.

Rail Service Equity Analysis Results

As discussed above, service changes on the Waterbury Line qualify as major service changes, as defined in to CTDOT's Title VI Program. The line was analyzed using the criteria outlined above in the methodology section and the results of this equity analysis are described below.

Evaluation of Disparate Impacts on Minority Populations

The following stations on the NHL – Waterbury Line were classified by CTDOT Title VI Program as Minority Serving (see Table 2).

Table 2 – Minority Serving Stations on the NHL – Waterbury Line

NHL Main Line Stations	Minority Serving?
Waterbury	Y
Naugatuck	Y
Beacon Falls	N
Seymour	N
Ansonia	N
Derby-Shelton	N
Stratford	Y
Bridgeport	Y

Table 3 below displays the results of the Disparate Impact Analysis for headway changes. There are no disparate impacts in change in headways as the variance in average headways change between minority and non-minority serving stations was less than 15% in all instances.

Table 3 – NHL Waterbury Line – Disparate Impact Analysis for Headway Changes

NHL Waterbury Line - Headway Analysis Results	Average Headway Change: Minority Serving Stations	Average Headway Change: Non-minority Serving Stations	Variance*	Disparate Impact?
Weekday AM Peak Service Southward	-2.12%	-2.73%	-0.61%	N
Weekday Off-Peak Service Southward	-34.88%	-34.80%	0.08%	N
Weekday AM Off-Peak Service Northward	N/A	N/A	N/A	N/A
Weekday AM Peak Service Northward	N/A	N/A	N/A	N/A
Weekday Mid-Day Off-Peak Service Northward	-29.35%	-29.57%	-0.22%	N
Weekday PM Peak Service Northward	-42.97%	-42.31%	0.67%	N
Weekday PM Off-Peak Service Northward	N/A	N/A	N/A	N/A

*A negative number indicates that the average headway reduction at minority serving stations was less than the average headway reduction at non-minority serving stations.

**N/A indicates that there was either one or no trains during the identified peak and/or off-peak period and thus no headway.

Table 4 below displays the results of the Disparate Impact Analysis for station stop changes on the NHL Waterbury Line. There are four disparate impacts in station stop changes as the variance in average stop increase between minority and non-minority serving stations was greater than 15% in these four instances:

- Disparate impact created in AM PEAK service southward for stop changes because a Stratford (which is a minority-serving station) stop was absent yet stops were added at all other stations on the line.
- Disparate impact created in AM OFF-PEAK service northward for stop changes because a new stop was added to all stations on the line except Stratford (which is a minority-serving station).
- Disparate impact created in PM PEAK service northward for stop changes because a new stop was added to all stations on the line except Stratford (which is a minority-serving station) and the existing stop at Stratford is absent.
- Disparate impact created in PM OFF-PEAK service northward for stop changes as the Stratford stop in this period is absent, yet all other stations retained their stop in this period.

Table 4 – NHL Waterbury Line – Disparate Impact Analysis for Stop Changes

NHL Waterbury Line - Stop Analysis Results	Average Stop Change: Minority Serving Stations	Average Stop Change: Non-minority Serving Stations	Variance	Disparate Impact?
Weekday AM Peak Service Southward	12.50%	50.00%	37.50%	Y
Weekday Off-Peak Service Southward	37.50%	50.00%	12.50%	N
Weekday AM Off-Peak Service Northward	75.00%	100.00%	25.00%	Y
Weekday AM Peak Service Northward	0.00%	0.00%	0.00%	N
Weekday Mid-Day Off-Peak Service Northward	25.00%	33.33%	8.33%	N
Weekday PM Peak Service Northward	12.50%	50.00%	37.50%	Y
Weekday PM Off-Peak Service Northward	-25%	0%	25%	Y

Aggregate Rail System

Table 5 displays the aggregate minority populations of the service territories of each rail line compared to the minority populations of CTDOT's total rail system (including the Hartford Line) service territories in aggregate. There are no disparate impacts on the Waterbury line where major service changes occurred as the line's minority population does not exceed the total rail system minority service territory population by greater than 15%.

Table 5 – Aggregate Rail System Minority Population Comparison

	New Canaan Branch	Waterbury Line	Danbury Branch	Shore Line East	New Haven Line	Hartford Line	Total Rail System*
Total Population Served	210,759	489,384	279,318	393,207	834,375	651,020	1,920,610
Minority Population Served	80,476	235,064	96,724	165,851	403,431	347,292	816,063
% of Line Minority	38.18%	48.03%	34.63%	42.18%	48.35%	53.35%	42.49%
% Variation from Total Rail System	-4.31%	5.54%	-7.86%	-0.31%	5.86%	10.86%	N/A

*Note that some stations are shared with multiple rail lines. The total rail system calculations only include station service area populations once and is not the sum of each line's populations.

Evaluation of Disproportionate Burden Impacts on Low-Income Populations

The following stations on the NHL – Waterbury Line were classified in the CTDOT Title VI Program as Low-Income Serving. (See Table 6)

Table 6 – Low-Income Serving Stations on the NHL – Waterbury Line

NHL Waterbury Line Stations	Low-Income Serving?
Waterbury	Y
Naugatuck	N
Beacon Falls	N
Seymour	N
Ansonia	Y
Derby-Shelton	N
Stratford	Y
Bridgeport	Y

Table 7 below displays the results of the Disproportionate Burden Analysis for headway changes on the NHL Waterbury Line. No disproportionate burdens exist as the variance in average headways change between low-income and non-low-income serving stations is not more than 15% in any instance.

Table 7 – NHL Waterbury Line – Disproportionate Burden Analysis for Headway Changes

NHL Waterbury Line - Headway Analysis Results	Average Headway Change: Low Income Serving Stations	Average Headway Change: Non-Low Income Serving Stations	Variance*	Disproportionate Burden?
Weekday AM Peak Service Southward	-2.12%	-2.73%	-0.61%	N
Weekday Off-Peak Service Southward	-34.88%	-34.80%	0.08%	N
Weekday AM Off-Peak Service Northward	N/A	N/A	N/A	N/A
Weekday AM Peak Service Northward	N/A	N/A	N/A	N/A
Weekday Mid-Day Off-Peak Service Northward	-29.35%	-29.57%	-0.22%	N
Weekday PM Peak Service Northward	-42.97%	-42.31%	0.67%	N
Weekday PM Off-Peak Service Northward	N/A	N/A	N/A	N/A

*A negative number indicates that the average headway reduction at minority serving stations was less than the average headway reduction at non-minority serving stations.

**N/A indicates that there was either one or no trains during the identified peak and/or off-peak period and thus no headway.

Table 8 below displays the results of the Disproportionate Burden Analysis for station stop changes on the NHL Waterbury Line. Similar to the disparate impact analysis results, there are four disproportionate burdens in station stop changes as the variance in average stop change between minority and non-minority serving stations was greater than 15% in these four instances:

- Disparate impact created in AM PEAK service southward for stop changes because a stop at Stratford (which is a low-income-serving station) is absent yet stops were added at all other stations on the line.

- Disparate impact created in AM OFF-PEAK service northward for stop changes because a new stop was added to all stations on the line except Stratford (which a low-income-serving station).
- Disparate impact created in PM PEAK service northward for stop changes because a new stop was added to all stations on the line except Stratford (which is a low-income-serving station) and the existing stop at Stratford is absent.
- Disparate impact created in PM OFF-PEAK service northward for stop changes as the Stratford stop in this period is absent, yet all other stations retained their stop in this period.

Table 8 – NHL Waterbury Line – Disproportionate Burden Analysis for Stop Changes

NHL Waterbury Line - Stop Analysis Results	Average Stop Change: Low Income Serving Stations	Average Stop Change: Non-Low Income Serving Stations	Variance	Disproportionate Burden?
Weekday AM Peak Service Southward	12.50%	50.00%	37.50%	Y
Weekday Off-Peak Service Southward	37.50%	50.00%	12.50%	N
Weekday AM Off-Peak Service Northward	75.00%	100.00%	25.00%	Y
Weekday AM Peak Service Northward	0.00%	0.00%	0.00%	N
Weekday Mid-Day Off-Peak Service Northward	25.00%	33.33%	8.33%	N
Weekday PM Peak Service Northward	12.50%	50.00%	37.50%	Y
Weekday PM Off-Peak Service Northward	-25%	0%	25%	Y

Aggregate Rail System

Table 9 displays the aggregate low-income populations of the service territories of each rail line compared to the low-income populations of CTDOT's total rail system (including the Hartford Line) service territories in aggregate. There are no disproportionate burdens on the Waterbury line where major services changes occurred as the line's low-income population did not exceed the total rail system low-income service territory population by greater than 15%.

Table 9 – Aggregate Rail System Low-Income Population Comparison

	New Canaan Branch	Waterbury Line	Danbury Branch	Shore Line East	New Haven Line	Hartford Line	Total Rail System*
Total Population Served	209,609	482,424	274,240	372,510	812,480	620,511	1,864,280
Low-Income Population Served	27,142	118,539	35,174	86,149	168,513	157,463	374,132
% of Line Low-Income	12.95%	24.57%	12.83%	23.13%	20.74%	25.38%	20.07%
% Variation from Total Rail System	-7.12%	4.50%	-7.24%	3.06%	0.67%	5.31%	N/A

*Note that some stations are shared with multiple rail lines. The total rail system calculations only include station service area populations once and is not the sum of each line's populations.

NHL Waterbury Rail Schedule Impacts and Alternatives

Summary of Impacts from Service Changes

The above analysis determined that there were no findings of disparate impact between minority and non-minority serving stations in the train headways from the service changes made to Connecticut's NHL Waterbury rail system per Table 3. However, there were technical findings of disparate impact between minority and non-minority serving stations when including consideration of stops at Stratford in the time periods specified, as referenced in Table 4.

No disproportionate burden was found in average headways variance between low-income and non-low-income serving stations resulting from the NHL Waterbury Summer 2022 service changes, as indicated in Table 7. There was found to be a technical disproportionate burden to low-income populations in service when considering Stratford stops in the Summer 2022 NHL Waterbury Line per Table 8, based on the established thresholds of CTDOT's Title VI SAFE Policies. These are summarized in the table below.

Table 10 – Disparate Impacts and Disproportionate Burden Evaluation Summary

Line	Service	Disparate Impact	Disproportionate Burden	Causes
NHL - Waterbury Line	Weekday Off-Peak & Peak Service to/from Bridgeport	Y - stops	Y - stops	Stratford Service

The following section examines the causes of the disproportionate burdens and whether alternatives exist to avoid, minimize, or mitigate these disproportionate burdens.

Causes and Alternatives to NHL Waterbury 2022 Service Changes

We observe that for the NHL Waterbury Line 2022 service changes, the amount of service at Stratford exceeded the 15% variance in both disparate impact between minority and non-minority populations and in disproportionate burden to low-income populations in the following weekday categories:

1.) Southward AM Peak service, 2.) Northward AM Off-Peak service, 3.) Northward PM Peak service, and 4.) Northward PM Off-Peak service.

Weekday Stratford Service - Stops

Background

The NHL Waterbury Line service currently consists of 15 weekday trains of which three stop at Stratford. Stratford is serviced by main line trains at an equivalent service level to other NHL main line stations. The three Stratford stops are only listed in the weekday NHL schedule; Stratford is not included in the listed weekend Waterbury train schedule. Stratford origin riders traveling in the Peak (AM Peak westbound, PM Peak eastbound) direction would be unlikely users, as this stop would require a next-station train change. The Stratford stops are more likely to be Waterbury Line riders' destination, or for connecting travel Milford and east, in either case reducing the backhaul for connecting travel.

Historically, Waterbury Line Stratford stops have varied in number and position based upon adjacent maintenance and construction programs, and special operating procedures have been used to accommodate the ridership needs. During the 2020-2022 pandemic, wide differences in train volumes and stop patterns had emerged, with the overall direction in building toward former service levels while balancing according to new trends. The service rebuilding effort is very much underway and is expected to continue gradually over several years as many other factors such as labor force, equipment and ancillary issues ripple through the recovery of public transportation.

The absence of Stratford stops from the NHL Waterbury schedule is the sole factor that influences the stop reduction average between minority and non-minority and low-income populations for service technically exceeding the variance threshold.

Substitute Stratford Service

While Stratford is a New Haven Line main line station, because the Waterbury trains pass Stratford, past stopping there has varied over time for passenger convenience. However, there are several additional options that support service between the Waterbury Line and Stratford without the addition of stops on the Waterbury Line trains:

Greater Bridgeport Transit (GBT)

The GBT service directly connects to both the Stratford and Bridgeport train stations and the Derby-Shelton train station on the Waterbury Line. At the Derby-Shelton train station, two southward AM Peak trains connect in less than 15 minutes to GBT bus route 23 to Stratford, and GBT 23 from Stratford connects to two northward PM Peak trains at Derby-Shelton, with similar travel times compared to the train service. While connecting to the 23 route adds a few minutes travel time difference, there is a wider choice of arrival times to and from Stratford, with midday service possible in both directions. This alternate minimizes the Stratford variance as a replacement option.

Bridgeport-Stratford Main Line

Travelers have another option in place of Waterbury Line Stratford stops, by using the main line service back between Bridgeport and Stratford. While this backhaul move is less convenient, it represents another travel option.

Clearly, there are options to addressing the rail stop disparity through a variety of alternate travel.

Stratford Stop Alternatives

Alternatively, looking at the absence of Stratford stops, the technical inequities have three alternatives:

- 1) Monitor Ridership, respond to perceived service need;
- 2) Remediate, introduce a measured alternative remediating service;
- 3) Restore and Add the former Stratford stops in the affected service periods.

Monitor Ridership

Monitoring ridership and fulfilling customer transportation needs is fundamental to CTDOT's mission. Monitoring the operation of the new schedule is also extremely important, as the service expansion relies on carefully timed train passing meets and equipment cycling, where a judicial approach to stop addition may be needed. One of the first steps in studying the ridership between the Waterbury Line and Stratford were from a recent CTDOT survey where there was one response from a person who would consider travel to Stratford from the Waterbury Line.

Remediate

The project team observes that there are several factors in operation concerning Stratford stops:

- 1) Elimination of the three stops currently operated;
- 2) Comparative inequities in service levels that the other seven stations would enjoy;
- 3) Skewing of data when attempting to remediate in new time periods.

Given these three separate elements, a step-by-step approach could progress starting with retaining Stratford in the southward AM Peak, and in the northward PM Peak and PM Off-Peak in the proposed Summer 2022 schedule. While this would not fully compensate for the disparate and disproportionate findings, it would serve to reduce downwards toward the 15% threshold variance. Another remediation step would be to also add a Stratford stop to the northward AM Off-Peak. In this manner the proposed NHL Waterbury Summer 2022 schedule would reduce the over 15% variance between minority and non-minority, and low-income populations.

Restore and Add

Another alternative would be to restore and add Stratford station stops to all NHL Waterbury Line trains. This would necessarily level the playing field for all stations, for all minority and non-minority, and for all low-income populations.

However, a very real cautionary note is that adding stops to the schedule also means increasing travel time, which could pose a problem in operating the new proposed Summer 2022 schedule. Experience with new train meets, operation of the new signal system, and seasoning of the expanded service may be necessary before adding stops. This may represent a CTDOT goal for the greater NHL service reset now underway, or for later enhancement to the NHL Waterbury Line service.

Rail Fare Equity Analysis

As part of its commitment to grow rail ridership within the State of Connecticut, CTDOT is modifying fare policies on the Hartford Line and Shore Line East. To help promote train ridership and to better align with the discount program available on the New Haven Line (Metro-North), Connecticut Department of Transportation (CTDOT) is proposing to increase the discount on the already discounted Hartford Line and Shore Line East 10-trip tickets, from ten trips for the price of nine to ten trips to the price of eight. This equates to an additional 11.1% discount on top of the already discounted 10 trip-ticket, which equates to a 20% reduction in value. The 10 trip-ticket discount will be referred to as a 20% discount throughout this document. As part of this initiative, CTDOT must conduct a Service and Fare Equity (SAFE) analysis to ensure that this new discount will not have a disparate impact on minority or low-income populations as defined in the CTDOT Title VI Program.

CTDOT Title VI Policy

This analysis aligns with the fare equity analysis process articulated in the CTDOT Title VI program:

As stated above, Federal law requires CTDOT to conduct a fare analysis that evaluates all proposed fare changes and any disparate impacts the fare change cause for minorities or low-income populations. CTDOT policy defines a disparate impact as:

A facially neutral policy or practice that disparately affects members of a group identified by race, color, or national origin, when the recipient's policy or practice lacks a substantial legitimate justification and when there exists one or more alternatives that would serve the same legitimate objectives but with less disparate impact on the basis of race, color, or national origin.

The Disparate Impact/Disproportionate Burden (DI/DB) policies set by CTDOT have the following thresholds for multiple fare changes:

A fare change will be deemed to have a disparate impact on minority populations or a disproportionate burden on low-income populations if its implementation results in either:

- 1. When one fare change is proposed, the percentage of impacts of the proposed fare change borne by minority or low-income riders as a result of the proposed fare change is at least ten (10%) percentage points higher than the percentage of impacts of that proposed fare change on the overall rider population; or*
- 2. When more than one fare change is proposed:*
 - a. For each fare change in the package: the percentage of impacts of each individual proposed fare change borne by minority or low-income riders as a result of the proposed fare change is at least ten (10%) percentage points higher than the percentage of impacts of that proposed fare change on the overall rider population; and*
 - b. For the total package of fare changes: the aggregate percentage of impacts for the proposed fare changes borne by minority or low-income riders as a result of the proposed fare changes is at least five (5%) percentage points*

higher than the aggregate percentage of impacts on the overall rider population.

While this fare equity analysis is analyzing a single fare change (20% ten-trip discount), it does so on two separately operated lines with different regional demographics, operators, fare structures and information informing the analysis. Given that differences exist and that the importance of the analysis in terms of advancing equity, the analysis team classifies this as two separate fare changes, meaning the Hartford Line and Shore Line East will be individually evaluated using the 5% disparate impact threshold and the collective package will be evaluated using the 10% disparate impact threshold.

Methodology

In alignment with the above-mentioned Title VI policy, the fare equity analysis involved two parts:

- Analysis A featured a review of disparate impacts, if any, for each line individually; and
- Analysis B featured a review of disparate impacts, if any, for the collective package.

This section summarizes the methodology used for each analysis.

Analysis A: Individual Rail Lines

Hartford Line

Understanding the current rates of Hartford Line fare media usage establishes existing conditions that can then be compared to changes as a result of the new 20% discount. This process utilized data from several CTDOT reports including:

- A 2020 Hartford Line Ridership Survey that provides demographic user information such as race/ethnicity, income, and fare media, among others;
- A 2021 CTrail Ridership and Revenue Report that provides summary statistics on Hartford Line station ridership and fare media purchased, price paid per fare; and
- A list of current Hartford Line fare media and costs.

While these different data elements are useful and allow CTDOT to assess the impact of proposed fare changes, there are several limitations to the overall study approach:

- The 2020 ridership survey asked individuals to identify their income by selecting one of ten household income ranges. The United States Department of Health and Human Services (HHS) Poverty Guidelines identify poverty level based on total household income and the number of individuals in the household. The poverty guidelines use precise values to define poverty and while the survey question ranges include these values, they do not match exactly as they include incomes both under and over poverty levels. To address this, survey responses that, after accounting for household size, selected a bracket including the 150% poverty level value, were considered to be low-income.
- In many instances, survey data were incomplete. If an entry related to minority or low-income status was listed as incomplete or if the origin and destination was vague, it was not included in the analysis. One exception to this rule involves low-income individuals. If an individual

reported under \$12,500 in household income and did not list any answer to the number of people in their household, they were still considered to be below the poverty level as \$12,500 is below 150% of the poverty level, regardless of the number of members in one's household.

- The COVID-19 Pandemic is still ongoing and while the ridership surveys are an indication of rail use, shifting travel patterns and pandemic phases are ongoing, meaning there is variance in the data.
- Many respondents indicated that they purchased a peak or off-peak ticket. At the time of this fare equity analysis, peak/off-peak fares are not in effect and these tickets were considered to be the same. Similar approaches were used for those who bought "senior" tickets or "disabled" tickets as the rate is the same.
- The 2020 survey indicated that zero low-income respondents utilized the ten-trip ticket. One possible reason for this is the up-front cost of a ten-trip ticket, as it may be too high for a low-income individual. While this might skew data, in absence of information that indicated specific low-income ten-trip purchases, the analysis team treated the zero as valid.
- The 2020 survey did not list the UniRail pass as an option for the survey, meaning the study team couldn't break down UniRail fare medium use by minority or income type. To address this gap in information, the analysis team only examined 2021 fare purchases at origins and destinations along the Hartford Line. Similarly, fare media purchase data indicated some users purchased a "monthly bus", "daily" or "child" ticket, though these were not options in the survey. These were not included in the analysis as the survey did not list these options. UPASS tickets were also discarded, as they were very context-specific and could not be applied to larger population estimates.

These assumptions noted, the project team took the following steps to determine whether minority or low-income Hartford Line riders would experience a disparate impact and/or disproportionate burden if the proposed fare change was implemented:

1. Using the 2020 ridership survey, the project team established the percentage of minorities and low-income individuals using the line. The survey asked individuals to list each race with which they identified. If an individual identified with any minority race, even if also identifying as white, they were considered to be a minority. Some listed "mixed" or "miscellaneous" as their race. These individuals were also considered to be minorities. Additionally, some survey respondents listed terms that could not be categorized, such as "human". These responses, in addition to blank responses, were not included in the analysis.
2. Once the percentage of minority and low-income users was identified, the project team then determined the fare media used by these different classifications. The ridership survey had asked individuals to report the fare medium used and responses were aggregated into a total and percentage by minority and low-income populations, as well as their counterparts.
3. Having established the survey response rates of minority and low-income populations, as well as their rates of fare media usage, the project team then applied these rates to the 2021 ridership and revenue report. For example, the 2020 survey indicated that 31.4% of ten-trip

tickets were purchased by minority-identifying individuals. Given that the 2021 fare sales show that 609 ten-trip tickets were sold, it was estimated that 31.4% or 191 ten-trip tickets were purchased by minorities. The same approach applied to low-income individuals and their respective counterparts.

4. The project team then estimated the average cost of each fare medium for each population classification (minority, low-income, and all riders) and compared values. The cost for the proposed discounted ten-trip tickets was calculated by taking the current 10% discount fares and obtaining the original price by removing the 10% discount. Then, the price was decreased by 20% to reflect the proposed fare change.
5. Finally, the project team analyzed the impact of a 20% fare discount on minority, low-income, and all riders. This involved taking the existing costs for the ten-trip ticket and adjusting the value to reflect the new discount. The percentage paid by minority and low-income groups was compared to all riders. If the percent change was below 10%, the analysis would conclude there is no disparate impact on minorities or low-income individuals.

Shore Line East

The process for analyzing the impact of the 20% discount on Shore Line East ten-trip tickets was very similar to the Hartford Line. Using information on current rates of Shore Line East fare usage allows CTDOT to establish existing conditions that can then be compared to changes as a result of the new 20% discount. This process was informed by several CTDOT data reports including:

- *A 2019 Shore Line East Ridership Survey* that provides demographic user information such as race, income, and fare media used, among others;
- *A 2021 CTrail Ridership and Revenue Report* that provides summary statistics on Shore Line East station ridership and fare media purchased, price paid per trip.
- *A 2021 Amtrak invoice* accounting for those who used Shore Line East tickets on an Amtrak train; and
- A list of current Shore Line East fare media and costs.

In ways nearly identical to the Hartford Line analysis, there were several limitations to this approach:

- The 2020 ridership survey asked individuals to identify their income by selecting one of ten household income ranges. The United States Department of Health and Human Services (HHS) Poverty Guidelines identify a poverty level based on total household income and the number of individuals in the household. The poverty guidelines use precise values to define poverty and while the survey question ranges include these values, they do not match exactly as they include incomes both under and over poverty levels. To address this, survey responses that, after accounting for household size, selected a bracket including the 150% poverty level value, were considered to be low-income.
- In many instances, survey data were incomplete. For example, if an entry related to minority or low-income status was listed as incomplete or included answers that did not apply to the question, it was not included in the analysis. One exception to this rule involves low-income

individuals. If an individual reported under \$12,500 in income and did not list any answer to the number of people in their household, they were still considered to be below the poverty level as \$12,500 is below 150% of the poverty level, regardless of the number of members in one's household.

- The COVID-19 Pandemic is still ongoing and while the ridership surveys are an indication of rail use, shifting travel patterns and pandemic phases are ongoing, meaning there is variance in the data.
- Many respondents indicated that they purchased a peak or off-peak ticket. At the time of this fare equity analysis, peak/off-peak fares are not in effect and these tickets were considered to be the same. Similar approaches were used for those who bought "senior" tickets or "disabled" tickets as the rate is the same.
- While the Amtrak invoice provided the collective sum of Shore Line East one-way fares purchased in 2021, it only provided revenue information for on-board, one-way tickets. To account for this, the total number of off-board, one-way fares purchased was multiplied by the average cost of a fare in the *2021 CTrail Ridership and Revenue Report*. These two were then combined and a weighted average was used to calculate the average one-way fare price.
- While survey respondents indicated that they purchased either a UniRail one-way or monthly ticket, there was no information on other UniRail information. Amtrak data indicated that users purchased other UniRail passes. Because demographic information was only available for the UniRail monthly pass, this was the only information included in the analysis. Additionally, UPASS tickets were also discarded, as they were very context-specific and could not be applied to larger population estimates.

These assumptions noted, the analysis team took the following steps to determine whether minority or low-income Shore Line East riders would experience a disparate impact and/or disproportionate burden if the proposed fare change was implemented:

1. Using the 2019 ridership survey, the project team established the percentage of minorities and low-income individuals using the line. The survey asked individuals to list each race for which they identified. If an individual identified with any minority race, even if also identifying as white, they were considered to be a minority. Some listed "mixed" or "miscellaneous" as their race. These individuals were also considered to be minorities. Additionally, some survey respondents listed terms that could not be categorized, such as "human". These responses, in addition to blank responses, were not included in the analysis.
2. Once the percentage of minority and low-income users was identified, the analysis team then determined the fare media used by these different communities. The ridership survey asked individuals to report the fare medium that they used, and responses were aggregated into a total and percentage by minority and low-income populations, as well as their counterparts.
3. Having established the survey response rates of minority and low-income populations among total riders, as well as their rates of fare media usage, the analysis team then applied these rates to the 2021 ridership and revenue report. For example, the 2019 survey indicated that

10.9% of ten-trip tickets were purchased by minority-identifying individuals. Given that the 2021 fare sales show that 798 ten-trip tickets were sold, it was estimated that 10.9% or 87 ten-trip tickets were purchased by minorities.

4. The project team then estimated the average cost of each fare medium for each population classification (minority, low-income, and all riders) and compared values. Costs were calculated by taking the current 10% discount fares and obtaining the original price by removing the 10% discount. Then, the price was decreased by 20% to reflect the proposed fare change.
5. Finally, the project team analyzed the impact of a 20% fare discount on minority, low-income, and all riders. This involved taking the existing costs for the ten-trip ticket and adjusting the value to reflect the new discount.

Analysis B: Full Package

The project team used the data created in Analysis A to build the model for Analysis B. There are several differences between the Hartford Line and Shore Line East, including fare media available, regional demographics, and levels of service. Additionally, the estimates for the Hartford Line were informed by a 2020 survey whereas the Shore Line East was informed by a 2019 survey. Recognizing that different data sources informed the analysis for each element of the full package, weighted averages were calculated for each line's three classes of ridership (all riders, minority riders and low-income riders).

Fare Change Analyses

Analysis A: Individual Lines

Hartford Line

To encourage ridership and adapt to changing travel patterns, CTDOT plans to increase the discount on the Hartford Line ten-trip ticket from its current 10% rate to 20%. The 20% discount on ten-trip tickets applies to all Hartford Line passengers. All classes will save money, and the percentage change in the average passenger fare is -0.5%. Minorities utilize the ten-trip ticket at a lower rate so the percentage change in their average fare is slightly lower. The low-income riders surveyed did not use the ten-trip ticket and their average fare did not change. Below is a summary of the process used to make these determinations.

Table 11 shows fare media usage patterns among minority and low-income passengers relative to passengers as a whole, with the ten-trip ticket highlighted in yellow. As stated in the methodology section, this information is based off a 2020 on-board customer survey.

Table 11 – 2019 Ridership Survey Hartford Line Fare Medium Use¹

Fare Medium	All Passengers %	Minority %	Low-income %
Ten-trip Ticket	5.43%	31.4%	0.0%
Monthly	13.09%	31.7%	10.3%
One Way Senior/Disabled Ticket	6.38%	30.0%	29.8%
One Way Ticket	72.98%	46.4%	27.1%
Ten-trip Senior/Disabled Ticket	1.17%	27.3%	0.0%
Weekly Pass	5.43%	22.2%	55.6%

Source: 2019 CTrail Ridership Survey

Using 2021 fare sales information, the annual total amount of fare paid per boarding was calculated for each fare medium. This involved taking the total sales of each fare medium and applying the usage percentages to the total number of fares sold in 2021. A full set of fare medium tables for the Hartford Line and Shore Line East can be found in **Appendix D**. As shown in Table 12, it is estimated that minorities purchased 216 ten-trip tickets during the 2021 calendar year.

Table 12 – Estimated 2021 Hartford Line Fare Medium Usage by Class

Fare Medium	All Purchases	% All Purchases	Minority Estimate	% Minority	Low-income Estimate	% Low-income
Ten-trip Ticket	690	0.5%	216	31.4%	0	0.0%
Monthly	349	0.3%	111	31.7%	36	10.3%
One Way Senior/Disabled Ticket	32,250	23.7%	9,675	30.0%	9,618	29.8%
One Way Ticket	102,135	75.2%	47,345	46.4%	27,669	27.1%
Ten-trip Senior/Disabled Ticket	164	0.1%	45	27.3%	0	0.0%
Weekly Pass	250	0.2%	56	22.2%	139	55.6%
Grand Total	135,838		57,448		37,462	

Source: 2021 CTrail Ridership and Revenue Report & 2019 Ridership Survey

The *2021 CTrail Ridership and Revenue Report* provided the cost of every fare purchase in 2021. Given that different travel distances cost different fares, an average fare price, by fare medium, was determined. Then it was multiplied by the total number of purchased fares for each class. This provided the analysis team with information on total annual fare expenses by class (see Table 13).

¹ For minority and low-income columns, this percentage refers to the number of minorities purchasing a given fare medium. For example, 31.4% of all ten-trip tickets were purchased by minorities.

Table 13 - Annual Hartford Line Fare Expenses by Medium by Class (Pre-20% Discount)

Fare Medium	Avg Fare Per Trip	Total Fare Paid All Users	Total Fare Paid Minority	Total Fare Paid Low-income
Ten-trip Ticket	\$58.43	\$40,313	\$12,647.29	\$0.00
Monthly	\$117.97	\$41,171	\$13,054.06	\$4,259.02
One Way Senior/Disabled Ticket	\$3.61	\$116,263	\$34,878.98	\$34,675.00
One Way Ticket	\$6.97	\$712,138	\$330,116.45	\$192,920.33
Ten-trip Senior/Disabled Ticket	\$32.41	\$5,315	\$1,449.55	\$0.00
Weekly Pass	\$36.38	\$9,094	\$2,020.83	\$5,052.08
Total		\$924,293.75	\$394,167.16	\$236,906.43

Source: 2021 CTrail Ridership and Revenue Report and 2019 Ridership Study

To determine total annual expenses after the ten-trip 20% discount was applied, the team adjusted ten-trip costs by removing the current 10% discount and discounting the “original” ten-trip price by 20%. Using the same process for calculating, the total expenses by fare medium, by class, were calculated to show the 20% discount (see Table 14).

Table 14 - Annual Hartford Line Fare Expenses by Medium by Classification (Post-20% Discount)

Fare Medium	Avg Fare Per Trip	Total Fare Paid All Users	Total Fare Paid Minority	Total Fare Paid Low-income
Ten-trip Ticket	\$51.93	\$35,834	\$11,242.04	\$0.00
Monthly	\$117.97	\$41,171	\$13,054.06	\$4,259.02
One Way Senior/Disabled Ticket	\$3.61	\$116,263	\$34,878.98	\$34,675.00
One Way Ticket	\$6.97	\$712,138	\$330,116.45	\$192,920.33
Ten-trip Senior/Disabled Ticket	\$32.41	\$5,315	\$1,449.55	\$0.00
Weekly Pass	\$36.38	\$9,094	\$2,020.83	\$5,052.08
Total		\$919,814.50	\$392,761.90	\$236,906.43

2021 CTrail Ridership and Revenue Report and 2019 Ridership Study

Shore Line East

The 20% discount on ten-trip tickets applies universally to all Shore Line East users. All classes will save money, however, because minority and low-income passengers utilize the ten-trip ticket at a rate lower than all passengers, the discounts in total average fare paid by minority and low-income passengers were slightly less than that of all passengers. Below is a summary of the process used to make these determinations.

Table 15 shows fare usage patterns among minority and low-income passengers relative to all passengers, with the ten-trip ticket highlighted in yellow. As stated in the methodology section, this information is based on a 2019 on-board customer survey.

Table 15 -2019 Shore Line East Ridership Survey Fare Medium Use by Class²

Fare Medium	All Passengers %	Minority %	Low-income %
Monthly pass (does not include New Haven Commuter Connection bus service)	26.4%	13.1%	3.5%
Monthly Plus (includes New Haven Commuter Connection bus service)	5.5%	7.1%	4.3%
Ten-trip Ticket	9.1%	10.9%	13.2%
One Way Ticket	39.0%	21.7%	23.1%
Senior/disabled Ten-trip Ticket	2.6%	14.3%	7.7%
Senior/disabled One Way Ticket	9.9%	12.2%	13.2%
UniRail Monthly Pass	6.5%	8.8%	3.8%
UniRail One Way Ticket	1.0%	33.3%	16.7%

Source: 2020 Ridership Survey

Using 2021 fare sales, the annual number of fares paid by population classification was calculated for each fare medium. This involved taking the total sales of each fare medium and using percentages from- to estimate the number of tickets purchased by minorities and low-income individuals. As shown in Table 16**Error! Reference source not found.**, an estimated 88 ten-trip tickets were purchased by minorities during the 2021 calendar year. Low-income individuals purchased an estimated 107 ten-trip tickets during the 2021 calendar year.

² For minority and low-income columns, this percentage refers to the number of minorities purchasing a given fare medium. For example, 10.9% of all ten-trip tickets were purchased by minorities.

Table 16 - Estimated 2021 Shore Line East Fare Medium Usage by Class

Fare Medium	All Purchases	Minority Estimate	Low-income Estimate
Monthly pass (does not include New Haven Commuter Connection bus service)	624	82	22
Monthly Plus (includes New Haven Commuter Connection bus service)	40	3	2
Ten-trip Ticket	811	88	107
One Way Ticket	49,282	10,703	11,395
Senior/disabled Ten-trip Ticket	329	47	25
Senior/disabled One Way Ticket	13,215	1,618	1,739
UniRail Monthly Pass	50	4	2
Total	64,351	12,545	13,291

Source: 2021 CTrail Ridership, Amtrak Invoice and Revenue Report & 2020 Ridership Survey

The 2021 CTrail Ridership and Revenue Report provided the cost of every fare purchase in 2021. Given that different trip distances cost different fares, an average fare price, per-fare medium was determined. Then, it was multiplied by the total number of fares purchased for each class. This provided the analysis team with information on total annual fare expenses by class (see Table 17).

Table 17 - Annual Shore Line East Fare Expenses by Medium by Class (Pre-20% Discount)

Fare Medium	Avg Fare Per Trip	Total Fare Paid All Users	Total Fare Paid Minority	Total Fare Paid Low-income
Monthly pass (does not include New Haven Commuter Connection bus service)	\$109.01	\$68,023.45	\$8,937.39	\$2,386.79
Monthly Plus (includes New Haven Commuter Connection bus service)	\$164.95	\$6,598.08	\$471.29	\$286.87
Ten-trip Ticket	\$48.28	\$39,156.09	\$4,256.10	\$5,152.12
One Way Ticket	\$8.93	\$440,118.34	\$95,581.26	\$101,761.47
Senior/disabled Ten-trip Ticket	\$13.67	\$4,498.00	\$642.57	\$346.00
Senior/disabled One Way Ticket	\$4.41	\$58,243.74	\$7,131.89	\$7,663.65
UniRail Monthly Pass	\$152.40	7620.16129	\$672.37	\$293.08
Total		\$624,257.87	\$117,692.86	\$117,889.98

Source: 2021 CTrail Ridership, Amtrak Invoice and Revenue Report & 2020 Ridership Survey

To determine total annual expenses after the ten-trip 20% discount was applied, the team adjusted ten-trip costs by removing the current 10% discount and discounting the “original” ten-trip price by 20%. Total expenses were then calculated by multiplying the total number of fares sold per class by the 20% discount value (see Table 18).

Table 18 - Annual Shore Line East Fare Expenses by Medium by Class (Post-20% Discount)

Fare Medium	Avg Fare Per Trip	Total Fare Paid All	Total Fare Paid Minority	Total Fare Paid Low-income
Monthly pass (does not include New Haven Commuter Connection bus service)	\$109.01	\$68,023.45	\$8,937.39	\$2,386.79
Monthly Plus (includes New Haven Commuter Connection bus service)	\$164.95	\$6,598.08	\$471.29	\$286.87
Ten-trip Ticket	\$42.92	\$34,805.42	\$3,783.20	\$4,579.66
One Way Ticket	\$8.93	\$440,118.34	\$95,581.26	\$101,761.47
Senior/disabled Ten-trip Ticket	\$13.67	\$4,498.00	\$642.57	\$346.00
Senior/disabled One Way Ticket	\$4.41	\$58,243.74	\$7,131.89	\$7,663.65
UniRail Monthly Pass	\$152.40	\$7,620.16	\$672.37	\$293.08
Total		\$612,287.03	\$116,547.59	\$117,024.44

Source: 2021 CTrail Ridership, Amtrak Invoice and Revenue Report & 2020 Ridership Survey

Analysis B: Full Package

Once individual average fares were determined for each line, the two lines were combined to make the full package. This involved taking the average fare for each line and multiplying it by the total number of fares sold on that line. These were then added together and divided by the sum of the fares for each line. This process was repeated for both minority and low-income groups. The average fare for all riders decreased by \$0.08. Collective minority and low-income fares decreased by \$0.04 and \$0.02.

Determination of a Discriminatory Impact

In alignment with CTDOT Title VI policy, the analysis team conducted two analyses to determine if there was a discriminatory impact:

- Analysis A examined the differences in percentage change between all passengers and minority/low-income passengers for the Hartford Line and Shore Line East individually; and
- Analysis B examined the differences in percentage change between all passengers and minority/low-income passengers for the Hartford Line and Shore Line East as a single, collective package.

Analysis A: Individual Lines

Hartford Line

The percentage change for each Hartford Line class showed that all passengers will experience a 0.5% decrease in average fare and minority passengers will experience a 0.4% decrease in average fare. Given that the difference between minorities and low-income individuals is 0.1% and 0.5% respectively, and that both these values are below the CTDOT-mandated 10% threshold, there is no finding of a disparate impact on the Hartford Line. (See Table 19)

Table 19 - Percent Change in Hartford Line Fare Payments

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$6.80	\$6.86	\$6.32
Average Fare Post-20% Discount	\$6.77	\$6.84	\$6.32
Percent Change	-0.5%	-0.4%	0.0%

Source: 2021 CTrail Ridership and Revenue Report and 2020 Ridership Study

Shore Line East

The percentage change for each Shore Line East class shows that all passengers will experience a 1.9% decrease in average fare (see Table 20). Minority and low-income passengers will experience a 1.0% and 0.7% decrease in average fare, respectively. Given that the difference between all passengers and minority/low-income passengers is 0.9% and 1.2%, and that these values fall below the CTDOT-mandated 10% threshold, there is no evidence of a disparate impact.

Table 20 - Percent Change in Shore Line East Fare Payments

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$9.70	\$9.38	\$8.87
Average Fare Post-20% Discount	\$9.51	\$9.29	\$8.80
Percent Change	-1.9%	-1.0%	-0.7%

Source: 2021 CTrail Revenue Report, Amtrak Invoice and 2019 Ridership Survey

Analysis B: Full Package

As stated in the methodology, Hartford Line and Shore Line East data were combined and weighted based on their total estimated annual ridership. The percentage change analysis revealed that the change, following the 20% discount, for minority and low-income ridership was 0.5% and 0.2%. Compared to all passengers, the difference for minority and low-income passengers was 0.6% and 0.8%, respectively. Because both differences are below the 5% disparate impact threshold, the analysis concludes that the proposed fare changes for the full package do not have a disparate impact on minority or low-income populations. (See Table 21)

Table 21 - Percent Change in Full Package Payments

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$7.74	\$7.31	\$6.99
Average Fare Post-20% Discount	\$7.65	\$7.28	\$6.97
Percent Change	-1.1%	-0.5%	-0.2%

Source: 2021 CTrail Revenue Report, Amtrak Invoice and & 2019 2020 Ridership Survey

Fare Impacts and Alternatives

There is no finding of disparate impact or disproportionate burden for both individual lines (satisfying the first component of CTDOT policy) and the total package (satisfying the second component of CTDOT policy). Therefore, no mitigations or alternatives must be considered.

Bus

Proposed Bus Service Changes

The following bus routes have proposed changes. A description of these route's current service plans and proposed route changes are described.

Hartford Division (Local routes and Express services)

24 Windsor - Bradley International Airport

Current Service Plan

Route 24 is a local bus route connecting CTrail Hartford Line Windsor Station, the Poquonock Park & Ride, Bradley International Airport, the Windsor Locks Park & Ride and CTrail Hartford Line Windsor Locks Station. Service operates from 5:30 AM to 11:30 PM on weekdays only. No Saturday or Sunday service is provided on this route.

Proposed Route Changes

Route 24 began service in August of 2021, and ridership demand on this route has continued to grow. To meet increased demand on weekdays, the changes proposed will improve connections between the CTrail Hartford Line - Windsor Locks station and Bradley International Airport. The Route 24 schedule will be coordinated so that there is a bus connection to every CTrail Hartford Line train to/from Springfield, Massachusetts and to/from points north at Windsor Locks station. Route 24 is displayed in Figure 2.

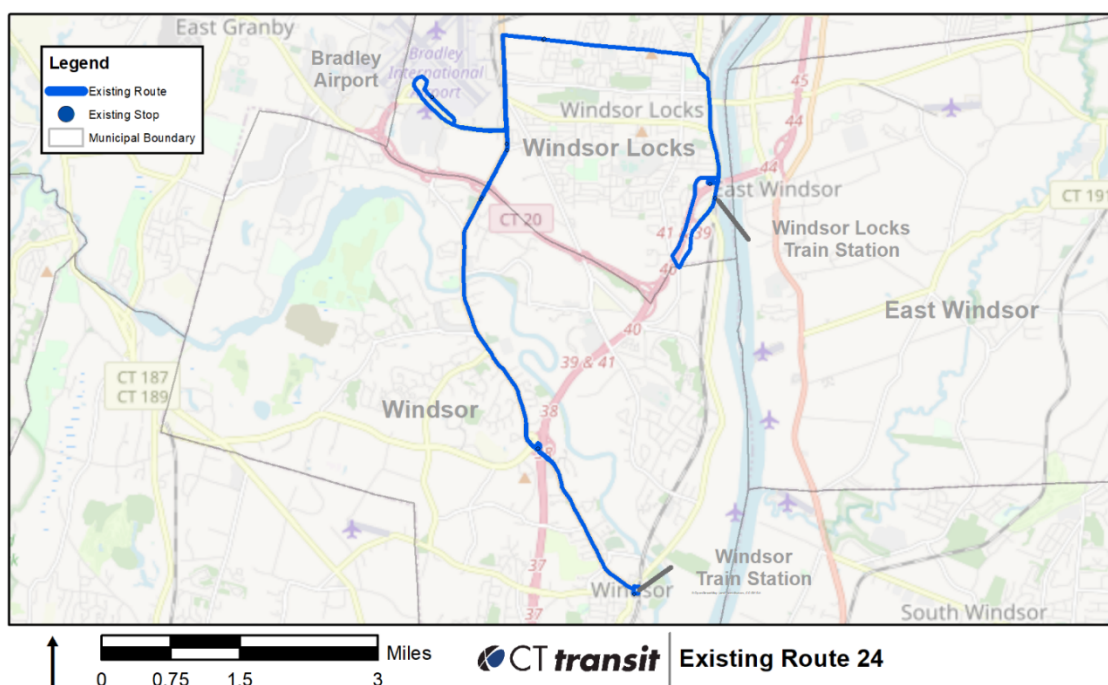


Figure 2 - 24 Windsor - Bradley International Airport

Bradley-Union Connector

Current Service Plan

Not applicable.

Proposed Route Changes

The Bradley-Union Connector will be separate from the existing Route 30 Bradley Flyer. The Bradley-Union Connector will make only two stops along its route:

- Union Place at Hartford Union Station
- Bradley International Airport Terminal A

The proposed schedule for the Bradley-Union Connector will be coordinated with Amtrak and CTrail train arrivals and departures at Hartford Union Station.

Service is proposed to operate seven days a week. On weekdays, the service would be provided from 5AM to 11PM, on Saturdays from 6AM to 11PM, and on Sundays from 6AM to 11PM.

The new route is displayed in Figure 3.

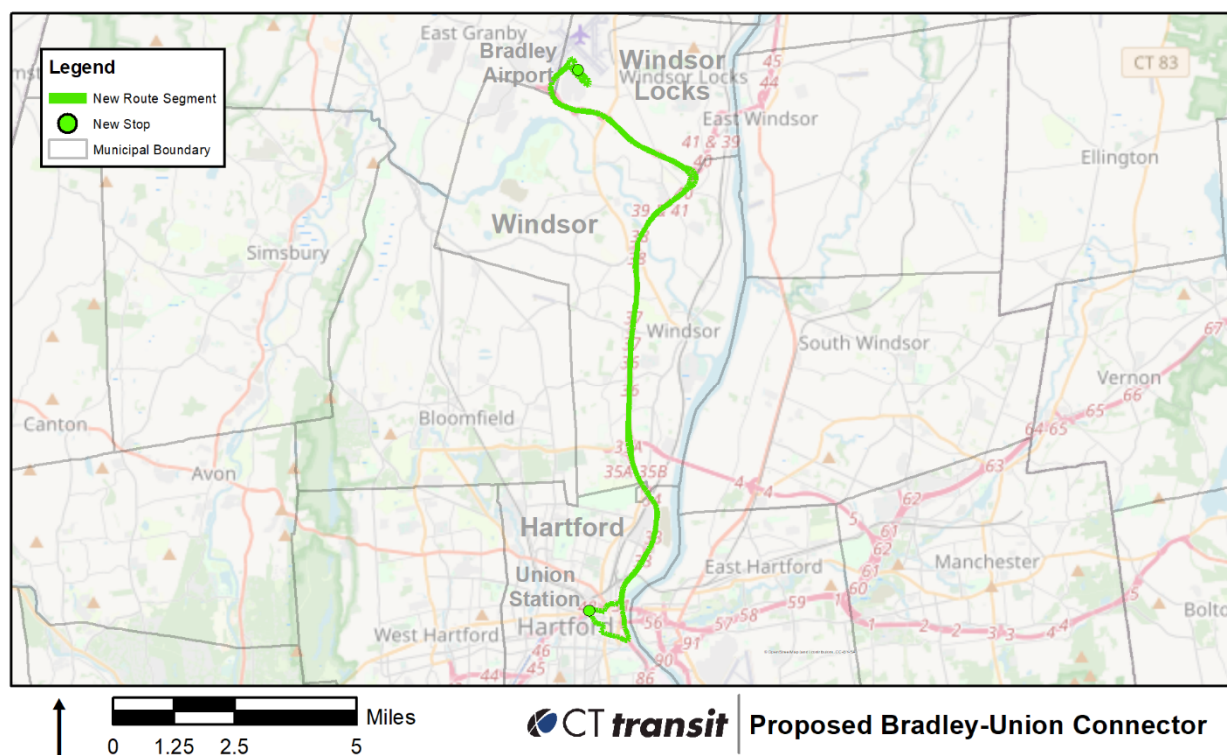


Figure 3 - Bradley-Union Connector

512 South Main Street-Berlin Turnpike

Current Service Plan

Route 512 is a local bus route connecting New Britain, Berlin, Cromwell and Newington. Service operates from 5:30 AM to 1:00 AM on weekdays, from 6:00 AM to 1:00 AM on Saturdays and from 7:30 AM to 8:30 PM on Sundays.

Proposed Route Changes

It is proposed to expand service on the Route 512C (Walmart Cromwell-Berlin Turnpike) by increasing its frequency during the weekday AM and PM peak periods, from approximately every 60 minutes to every 30 minutes. This increase in peak service will benefit *CTrail* Hartford Line customers who seek to travel to activity centers on the Berlin Turnpike, as well as downtown New Britain via a timed transfer at the *CTrail* Berlin station.

Under the proposed schedule change, there will be seven timed transfer connections to/from downtown New Britain on weekday mornings and eleven timed transfer connections to/from downtown New Britain on weekday afternoons.

In addition, there will be three timed transfer connections to Berlin Turnpike on weekday mornings and three timed transfer connections from Berlin Turnpike on weekday afternoons.

940 Waterbury – Meriden Express

Current Service Plan

Not applicable.

Proposed Route Changes

It is proposed to make the pilot Route 940 a permanent route.

The primary goal of the pilot bus route between Waterbury and Meriden was to provide a direct route and strengthen the connections to train arrivals/departures between Waterbury and Meriden. The 940 service assists in solving what was a significant service gap between these two cities, which are approximately 15 miles apart. Prior the introduction of 940 pilot bus route, customers that wished to travel between Waterbury and Meriden by bus had to go south to New Haven and transfer to either Route 215 to Meriden or Route 229 to Waterbury. This trip could take in excess of two to three hours to complete (see Figure 4 below).

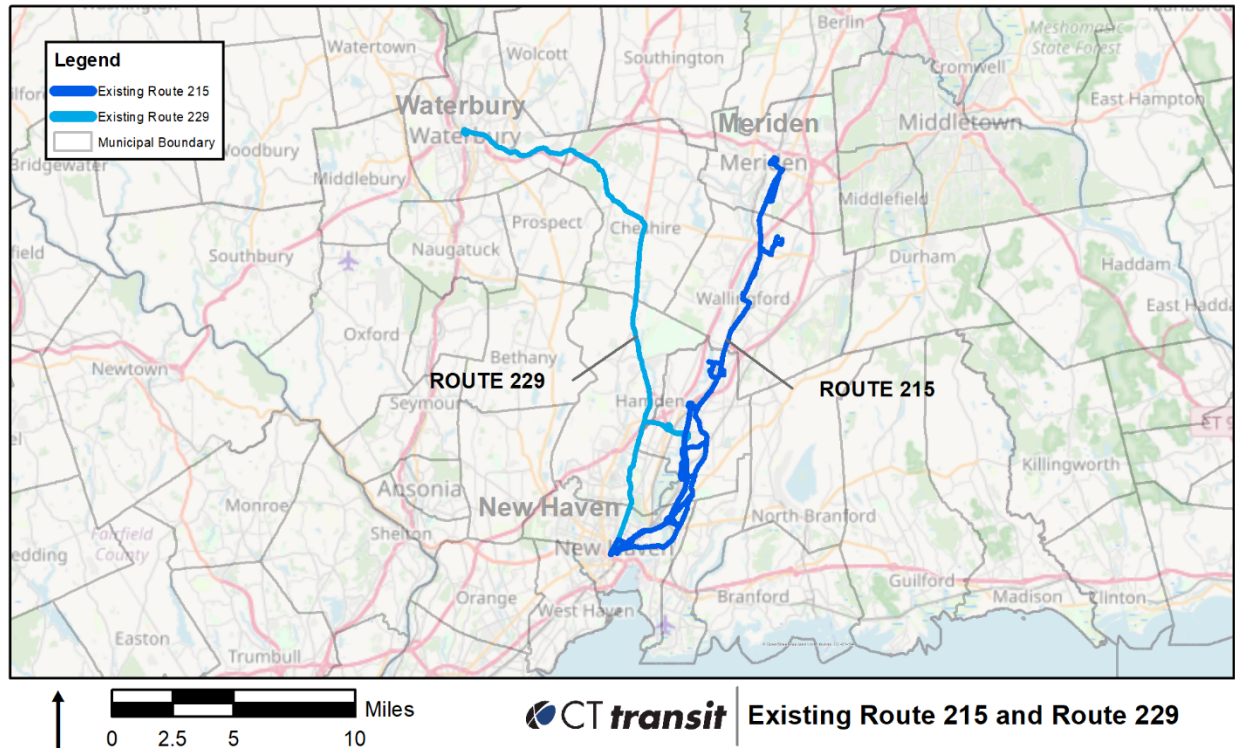


Figure 4 - Former Routing Between Waterbury and Meriden

Effective January 10, 2022, the pilot Route 940 began operation. The routing provides direct service between Waterbury and Meriden (see Figure 5 below). In addition to providing connectivity between these two cities, the schedule also aligns with the train service at the CTrail Hartford Line Meriden station. The route operates from Monday through Sunday.

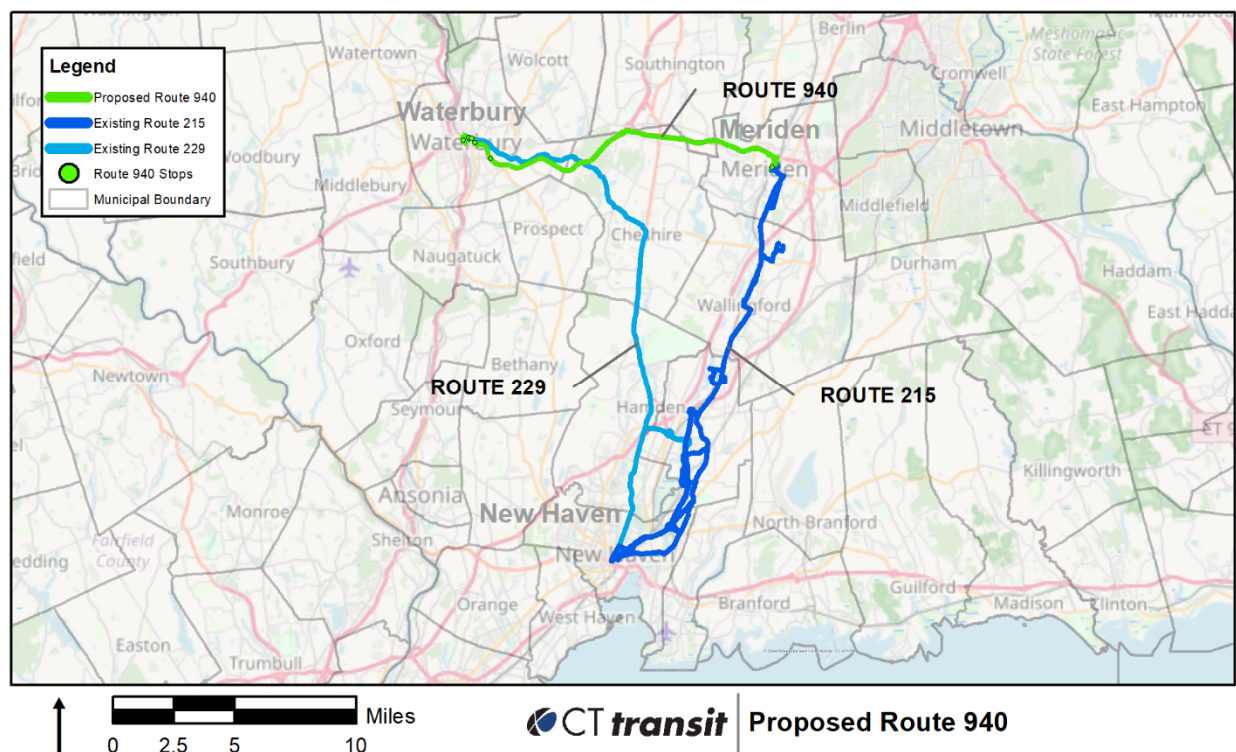


Figure 5 - New 940 Route

New Haven Division (Local service)

282 East Grand Avenue Bus Bridge

On April 13, 2020, the Grand Avenue Bridge closed for a two-year construction project. This bridge closure directly impacted the routing of Route 212 Grand Avenue, which is one of the most utilized bus routes in the CTtransit New Haven system (see Figure 6 below). The bridge connects the Fair Haven Heights neighborhood to the Fair Haven neighborhood and to downtown New Haven. The greatest impact of this closure was to Bella Vista Apartments located in Fair Haven Heights, which is a large apartment complex providing housing to individuals 55 years of age and over.

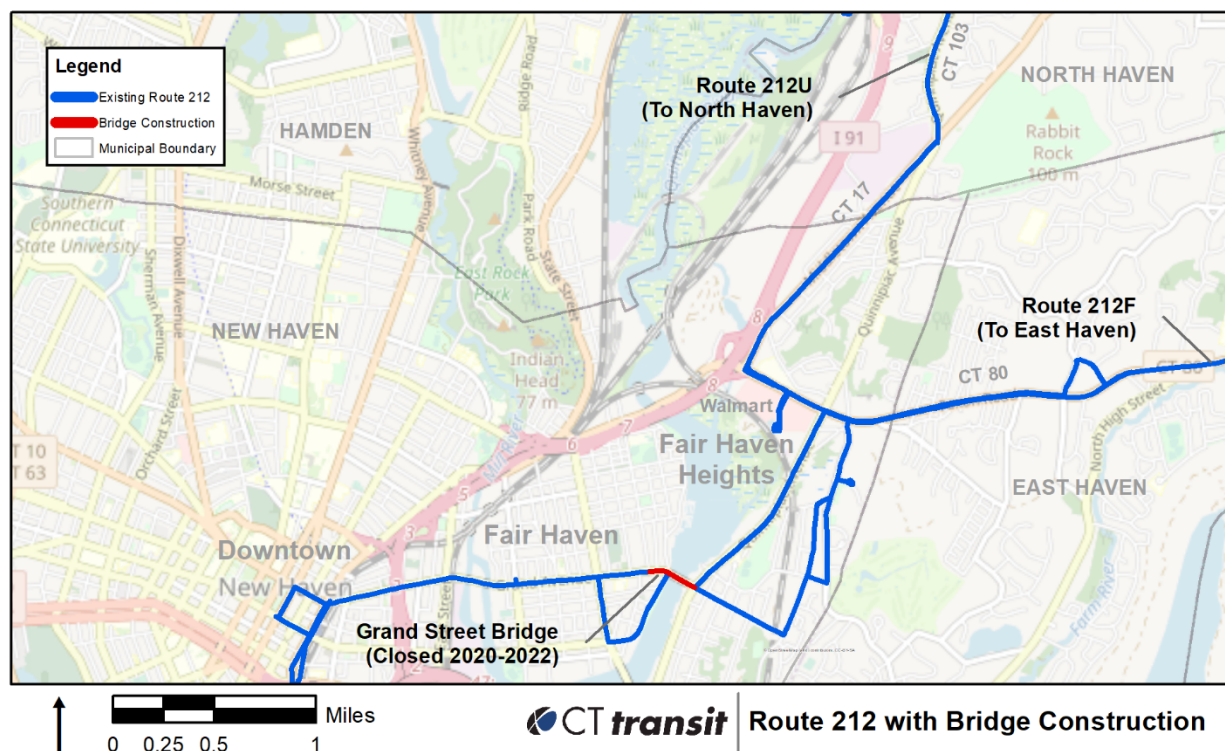
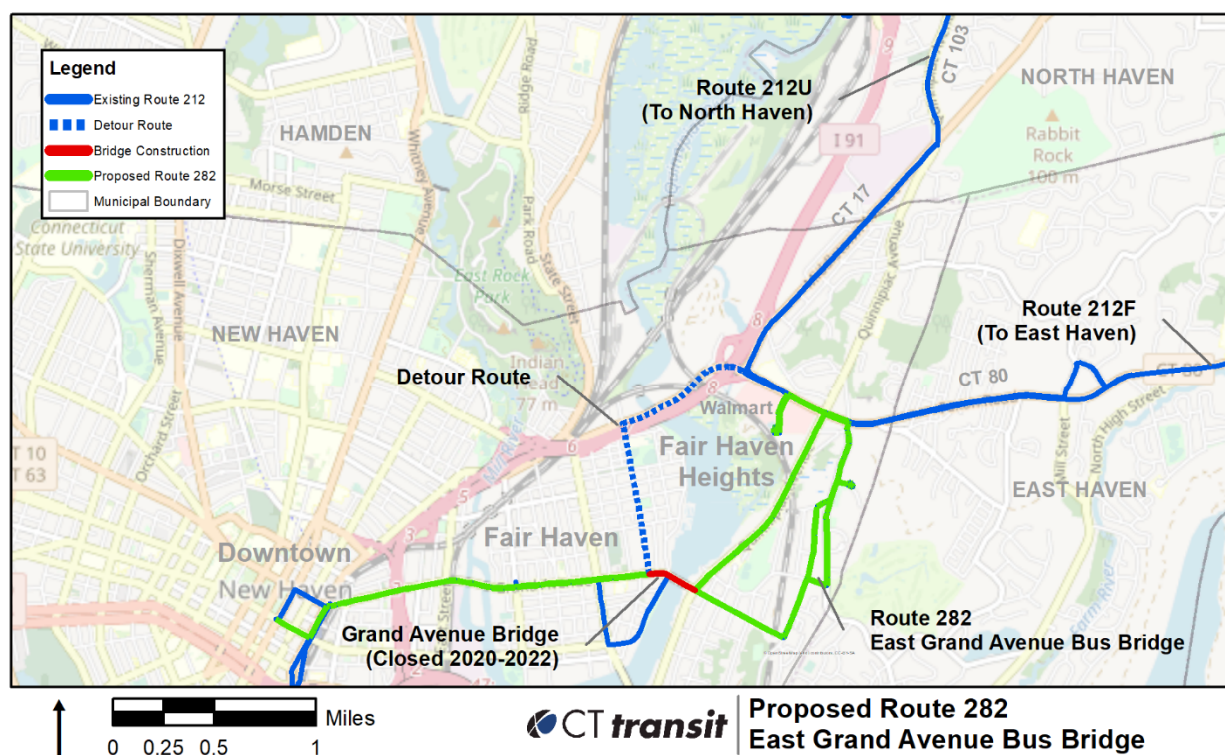


Figure 6 - Grand Avenue Bus Bridge Closure and Route 212

Due to the bridge closure, a new routing detour was created. This detour required Route 212 to travel north through the Fair Haven neighborhood to connect to the points east of the Quinnipiac River (see Figure 7 below). This detour added time to the schedule and impacted the 212's ability to maintain schedule reliability. To address this issue, a significant route structure change was necessary.

This change came in the form of developing a new separate route, that would directly serve the Fair Haven Heights neighborhood and the Bella Vista apartments. This new route is called Route 282 East Grand Avenue Bus Bridge route. It operates in a loop from Wal-Mart, south on Quinnipiac Avenue, east on E. Grand Avenue, north on Russell Street, east on Clifton Street, north on Eastern Street to Bella Vista where it continues back to Wal-Mart.



After its introduction, Route 282 route became one of the most efficient routes in the New Haven bus system. (see Table 22) The route attracts approximately 350 passengers per day and operates just over 17 total hours per day which results in 19.9 passengers per revenue hour (PPRH). This PPRH is the 4th highest in the New Haven system and is surrounded by routes that are in consideration for rapid transit investment.

Table 22 - Top 6 Passenger per Revenue Hour Efficiency for CTtransit New Haven

Route #	Route Name	Passengers Per Hour
238	DIXWELL AVENUE	21.3
265	CONGRESS AVENUE	20.3
243	WHALLEY AVENUE	20.3
282	EAST GRAND AVE BUS BRIDGE	19.9
212	GRAND AVENUE	19.3
261	BOSTON POST ROAD	18.2

* Data is from October 18-October 22, 2021

Proposed Route Changes

Given its strong performance, it is recommended that the Route 282 route be retained as a standalone service by permanently separating it from the Route 212.

Bus Routes Major Service Change Summary

The five bus routes included are proposed to have service changes. The routes and their proposed changes are:

- Routes 24 and 512 - schedule changes to allow for better coordination with CTrail Hartford Line trains,
- Route 940, Bradley - Union Connector and Route 282 – adding new routes

The changes to four routes exceed the thresholds for a Major Service Change; Route 512 was the exception.

The results of the Major Service Change threshold analysis are presented in **Appendix E**.

Bus Service Equity Analysis

Service Equity Analysis Methodology

CTDOT has identified and adopted policies to define what constitutes a major service change and has developed thresholds to be used to determine if a major service change creates a disparate impact on minority riders and/or a disproportionate burden on low-income riders. These are described in the Title VI Principles and Definitions section and were utilized in this analysis.

According to CTDOT's Title VI Program; bus system service areas are each defined as all census tracts that are within (and touching) within 0.25 miles of local weekday transit service, within 0.5 miles of local weekend transit service and within 2.5 miles of park and ride stops. Census 2013-2017 American Community Survey (ACS) data was utilized in the analysis.

For consistency with the CTDOT's current Title VI program, the 2013-2017 ACS data was utilized in the analysis. CTDOT's Disparate Impact/Disproportionate Burden Policy threshold of 15% was used to determine whether a disparate impact or disproportionate burden exists for major service changes.

Hartford Division (Express service and Local routes)

The equity analysis for the Hartford Division express bus and local routes with proposed major service changes were analyzed for the following:

1. Service Changes

- a) **Increased Service Frequency.** Route 24 will increase service frequency. With this proposed change there will be a bus connection to every CTrail Hartford Line train to and from Springfield, Massachusetts and to and from points north of Windsor Locks station.

The project team calculated the percent of low-income and minority populations within the service area. The percent of low-income and minority populations in the service area of each route was then compared to the average low-income and minority populations of the local Hartford bus network service area.

The project team calculated whether the route experiencing the service increase was less minority/low-income serving compared to the local Hartford system as a whole using a 15% threshold. If this threshold is crossed, then there is a disparate impact/disproportionate burden.

2. Route Changes

- a) **Adding New Express Route.** One new proposed express route (Route 940) is proposed. This is considered a positive change. The same analysis approach above was performed; however, if the route was found to be 15% less minority/low-income serving, then the proposed new route was considered to create a disparate impact/disproportionate burden.
- b) **Adding New Local Route.** There is one new proposed local route (Bradley-Union Connector). This is considered a positive change. The project team performed analysis to determine if the proposed local route is 15% less minority/low-income serving than the local Hartford bus system average and thus creating a disparate impact/disproportionate burden.

New Haven Division (local service)

There was one New Haven Division route that met the major service change threshold and was analyzed as follows:

1. Route Change

- a) **Adding New Local Route.** Route 282 is a new proposed local route. Analysis was performed to determine if the new route is 15% less minority/low-income serving than the local New Haven bus system average and thus creating a disparate impact/disproportionate burden.

If the analysis found that a disparate impact or disproportionate burden exists, the project team examined whether alternatives exist to maintain the effect of the major service change, while taking steps to avoid, minimize, or mitigate disparate or disproportionate burdens where practicable.

Bus Service Equity Analysis Results

The express and local routes with proposed service changes that qualify as major service changes according to CTDOT's Major Service Change Policy were analyzed using the criteria outlined above in the methodology section. The results of this equity analysis are described below.

Evaluation of Disparate Impacts to Minority Populations

This section presents the results of the evaluation of impacts to minority populations.

Hartford Division

There is one express route (Route 940) which is a new proposed route and considered a positive change. The minority population in the service area of this routes was calculated and compared to the average minority population in the service area of the entire Hartford Express bus system. Table 23 below displays the results of the Disparate Impact Analysis for the routes. There is no disparate impact.

Table 23 – Disparate Impact Analysis for Hartford Division Express Route with Positive Proposed Service Change

		940	Total Hartford Express Bus System
Proposed Change:		Creation of new route	
Total Population Served		223,713	1,783,750
Minority Population	Number of Persons	94,794	646,011
	% of Route	42.37%	36.22%
% Variation from Total Express Bus System		6.16%	N/A
Disparate Impact?		N	

There is one new proposed local route (Bradley – Union Connector) and one local route where an addition in service frequency is proposed (Route 24). Table 24 below displays the results of the Disparate Impact Analysis for these routes. A disparate impact is created with the proposed changes in Route 24's frequency.

Table 24 – Disparate Impact Analysis for Hartford Division Local Routes with Positive Proposed Service Change

		Bradley-Union Connector	24	Total Hartford Local Bus System
Proposed Change:		New Route	Increase in service frequency	
Total Population Served		12,102	29,305	701,668
Minority Population	Number of Persons	6,852	8,108	302,283
	% of Route	56.62%	27.67%	43.08%
% Variation from Total Local Bus System		13.54%	-15.41%*	N/A
Disparate Impact?		N	Y	

*The negative number indicates that the route is less minority-serving than the Local Bus system as a whole.

New Haven Division

There is one New Haven Division route that classifies as a major service change, the proposed Route 282. Creation of a new route is considered a positive change. Table 25 below demonstrates that there is no disparate impact created by the proposed route.

Table 25 – Disparate Impact Analysis for New Haven Division Proposed Bus Bridge Route

		282	Total New Haven Local Bus System
Proposed Change:		New Route	
Total Population Served		54,894	610,792
Minority Population	Number of Persons	33,965	237,356
	% of Route	61.87%	38.86%
% Variation from Total New Haven Bus System		23.28%	N/A
Disparate Impact?		N	

Evaluation of Disproportionate Burden to Low-Income Populations

This section presents the results of the evaluation of impacts to low-income populations.

Hartford Division

The creation of the new express Route 940 can be considered a positive change. Table 26 below displays the results of the Disproportionate Burden Analysis for this route.

Table 26 – Disproportionate Burden Analysis for Hartford Division Express Route with Positive Proposed Service Change

		940	Total Hartford Express Bus System
Proposed Change:		Creation of new route	
Total Population Served		221,057	1,714,137
Low-income Population	Number of Persons	52,903	324,736
	% of Route	23.93%	18.94%
% Variation from Total Express Bus System		4.99%	N/A
Disproportionate Burden?		N	

The Bradley-Union-Connector is a new proposed local route and Route 24 will have its peak period service frequency increased. Both of these are positive changes. Table 27 below displays the results of the Disproportionate Burden Analysis for these two routes.

Table 27 – Disproportionate Burden Analysis for Hartford Division Local Routes with Positive Proposed Service Changes

		Bradley-Union Connector	24	Total Hartford Local Bus System
Proposed Change:		Creation of a new route	Increase in service frequency	
Total Population Served		12,008	28,917	682,181
Low-Income Population	Number of Persons	2,907	2,757	138,859
	% of Route	24.21%	9.53%	20.36%
% Variation from Total Express Bus System*		3.85%	-10.82%	N/A
Disproportionate Burden?		N	N	

*The negative number indicates that the route is less low-income-serving than the Express Bus system as a whole.

New Haven Division

One new route, Route 282 Grand Avenue Bus Bridge, is proposed and is a positive change. Table 28 below demonstrates that there is not a disproportionate burden created by the proposed new route.

Table 28 – Disproportionate Burden Analysis for New Haven Proposed Bus Bridge Route

		282	Total New Haven Local Bus System
Proposed Change:		Creation of a new route	
Total Population Served		50,285	470,261
Low-Income Population	Number of Persons	16,786	118,688
	% of Route	33.38%	25.24%
% Variation from Total New Haven Bus System*		8.14%	N/A
Disproportionate Burden?		N	

Bus Service Change Impacts and Alternatives

The routes in Table 29 have been identified as having proposed service changes that trigger either a Disparate Impact and/or Disproportionate Burden. Mitigation or justifications for the proposed service changes are included.

Table 29 – Service Change Impacts and Alternatives – Hartford Local and Express Bus System

Route	Disparate Impact (Minority Populations)	Disproportionate Burden (Low-Income Populations)	Route Change Causing Impact	Mitigation or Justification
24 - Windsor - Bradley International Airport	Y	N	<ul style="list-style-type: none"> Increase in service frequency 	<p>The increase in service frequency change triggers a disparate impact as that route is slightly non-minority favoring.</p> <p>However, this is a change that benefits both minority and non-minority riders on the route by providing them with more frequent service.</p>

Appendix A - Summer 2022 Rail Major Service Change Threshold Analysis Results

The threshold analysis results for any proposed change that exceeded the major service change threshold for the Waterbury Line is presented in this appendix.

NHL Waterbury Line – Major Service Change

Threshold Analysis Results

The Waterbury Line is operated by Metro-North Railroad for CTDOT between Waterbury to/from Bridgeport/South Norwalk.

The Waterbury Line service was re-slotted to interconnect with Haven Line Main Line service, and adding 7 weekday trains to the service frequency as shown below. These were 4 Southbound and 3 Northbound train additions weekdays. The span of service changed weekdays, averaging an increase of over an hour on the Waterbury Line. Major service changes weekdays exceeded the 25% thresholds, increasing in stops, headways, and RVMS.

Table A1 - Waterbury Line Service Change Threshold Analysis

TITLE VI Service Changes				
<u>Waterbury</u>	<u>M-F</u>	<u>Sat</u>	<u>Sun</u>	<u>Per Week</u>
August 2021	15	12	12	99
Summer 2022	22	12	12	134
Change (-)	47%	0%	0%	35%

Appendix B - Rail Service Equity Analysis Schedule Analysis Tables

Table B1 - Waterbury Line Service Comparisons Between 2021 and 2022 (weekday, southward)

Waterbury Line M-F Southward				
COMPARISONS				
AM Peak		Off-Peak		
Stops	Headways	Stops	Headways	
50%	3%	50%	-35%	Waterbury
50%	3%	50%	-35%	Naugatuck
50%	3%	50%	-35%	Beacon Falls
50%	3%	50%	-35%	Seymour
50%	3%	50%	-35%	Ansonia
50%	3%	50%	-35%	Derby-Shelton
-100%	N/A	0%	N/A	Stratford
50%	1%	50%	-35%	Bridgeport

Table B2 - Waterbury Line Service Comparisons Between 2021 and 2022 (weekday, northward)

Waterbury Line M-F Northward										
COMPARISONS										
AM Off-Peak		AM Peak		Mid-day Off-Peak		PM Peak		PM Off-Peak		
Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	
100%	N/A	0%	N/A	33%	-28%	50%	-44%	0%	N/A	Bridgeport
0%	N/A	0%	N/A	0%	N/A	-100%	N/A	-100%	N/A	Stratford
100%	N/A	0%	N/A	33%	-29%	50%	-42%	0%	N/A	Derby-Shelton
100%	N/A	0%	N/A	33%	-30%	50%	-42%	0%	N/A	Ansonia
100%	N/A	0%	N/A	33%	-30%	50%	-42%	0%	N/A	Seymour
100%	N/A	0%	N/A	33%	-30%	50%	-42%	0%	N/A	Beacon Falls
100%	N/A	0%	N/A	33%	-30%	50%	-42%	0%	N/A	Naugatuck
100%	N/A	0%	N/A	33%	-30%	50%	-42%	0%	N/A	Waterbury

The above tables illustrate by Peak/Off-Peak period how the seven (7) train increase affects those service windows:

- For 2022, the Peaks receive 50% increases in service while reducing headways, chiefly Northward over 2021 service.
- For 2022, the mid-day Off-Peak receive 33%-50% more service while also reducing headways by over 30% over 2021 service.
- The absence of the three (3) Stratford stops – each in the AM Peak, PM Peak, PM Off-Peak are the only service reductions associated with this 2022 schedule.
- The introduction of an early Waterbury Southward departure weekdays is a new train that arrives New York via connecting train, before 6:00 a.m., representing a 100% increase to the AM Off-Peak (pre-AM Peak) time period.

Table B3 - Stops and Headways, Service Calculations (weekday, southward and northward)

Waterbury Line M-F Southward																				
	Aug-21										FUTURE									
	AM Peak					Off-Peak					AM Peak					Off-Peak				
	Stops	Headways				Stops	Headways				Stops	Headways				Stops	Headways			
Waterbury	2	55				6	153				3	57				9	100			
Naugatuck	2	55				6	153				3	57				9	100			
Beacon Falls	2	55				6	153				3	57				9	100			
Seymour	2	55				6	154				3	57				9	100			
Ansonia	2	55				6	153				3	57				9	100			
Derby-Shelton	2	55				6	153				3	57				9	100			
Stratford	1	0				0	0				0	0				0	0			
Bridgeport	2	56				6	153				3	57				9	100			

Waterbury Line M-F Northward																				
	Aug-21										FUTURE									
	AM Off-Peak		AM Peak		Off-Peak		PM Peak		PM Off-Peak		AM Off-Peak		AM Peak		Off-Peak		PM Peak		Off-Peak	
	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways	Stops	Headways
Bridgeport	0	0	1	0	3	151	2	158	1	0	1	0	1	0	4	108	3	88	1	0
Stratford	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Derby-Shelton	0	0	1	0	3	151	2	119	1	0	1	0	1	0	4	107	3	90	1	0
Ansonia	0	0	1	0	3	151	2	156	1	0	1	0	1	0	4	106	3	90	1	0
Seymour	0	0	1	0	3	151	2	158	1	0	1	0	1	0	4	106	3	90	1	0
Beacon Falls	0	0	1	0	3	151	2	156	1	0	1	0	1	0	4	106	3	90	1	0
Naugatuck	0	0	1	0	3	151	2	156	1	0	1	0	1	0	4	106	3	90	1	0
Waterbury	0	0	1	0	3	151	2	156	1	0	1	0	1	0	4	106	3	90	1	0

Appendix C - Rail Service Equity Analysis 2021 and 2022 Train Schedules

NEW YORK – WATERBURY

WEEKDAY SCHEDULE EFFECTIVE: 10/4/2021

MILES	TO NEW YORK	AM PEAK		OFF-PEAK					
		1925	1935	1951	1963	1971	1983	1991	1997
		3525	3535	1551	1563	1571	1583	1591	1497
		AM	AM	AM	PM	PM	PM	PM	PM
88	Waterbury	C 5 40	C 6 35	C 9 12	C 12 03	C 2 03	C 5 03	C 7 10	C 9 56
83	Naugatuck	C 5 49	C 6 44	C 9 21	C 12 12	C 2 12	C 5 12	C 7 19	C 10 05
78	Beacon Falls	C 5 56	C 6 51	C 9 28	C 12 19	C 2 19	C 5 19	C 7 26	C 10 12
75	Seymour	C 6 01	C 6 56	C 9 33	C 12 24	C 2 24	C 5 24	C 7 31	C 10 17
71	Ansonia	C 6 08	C 7 03	C 9 40	C 12 31	C 2 31	C 5 31	C 7 38	C 10 24
70	Derby-Shelton	C 6 12	C 7 07	C 9 44	C 12 35	C 2 35	C 5 35	C 7 42	C 10 28
59	Stratford		H 7 26						
55	Bridgeport Ar.	6 38	7 34	10 08	12 59	2 59	5 59	8 05	10 54
55	Bridgeport Lv.	6 42	7 37	10 13	1 10	3 05	6 05	8 12	11 00
41	South Norwalk	7 10	8 03	10 41	1 40	3 35	6 36	8 42	11 31
33	Stamford	7 26	8 20	10 58	1 56	3 51	6 51	8 58	11 46
4	Harlem - 125th St.	D 8 08	D 9 02	D 11 41	D 2 43	D 4 35	D 7 37	D 9 43	D 12 35
0	Grand Central Terminal	8 21	9 15	11 55	2 54	4 46	7 48	9 54	12 46
		AM	AM	AM	PM	PM	PM	PM	PM

Reflects the **August 29, 2021** schedule implementation.

MILES	TO WATERBURY	AM PEAK	OFF-PEAK				PM PEAK		OFF-PEAK
		1506	1516	1522	1534	1538	3544	3556	1574
		1906	1916	1922	1934	B1538	1944	B3556	1974
		AM	AM	PM	PM	PM	PM	PM	PM
0	Grand Central Terminal	6 16	9 04	11 04	2 04	3 04	4 11	5 28	6 53
4	Harlem - 125th St.	R 6 26	R 9 14	R 11 14	R 2 14	R 3 14	R 4 21	R 5 38	R 7 03
33	Stamford	7 09	9 55	11 55	2 55	3 53	5 11	6 16	7 42
41	South Norwalk	7 25	10 09	12 11	3 10	4 09	5 26	H 6 33	7 57
55	Bridgeport Ar.	7 55	10 37	12 40	3 39	4 36	5 52	H 7 01	8 25
55	Bridgeport Lv.	C 7 59	C 10 44	C 12 51	C 3 45	B 4 46	C 5 56	B 7 13	C 8 34
59	Stratford						C 6 03		R 11 49
70	Derby-Shelton	C 8 23	C 11 08	C 1 15	C 4 09	B 5 06	C 6 22	B 7 33	C 8 58
71	Ansonia	C 8 27	C 11 12	C 1 19	C 4 13	B 5 17	C 6 26	B 7 44	C 9 02
75	Seymour	C 8 34	C 11 19	C 1 26	C 4 20	B 5 28	C 6 33	B 7 55	C 9 09
78	Beacon Falls	C 8 40	C 11 25	C 1 32	C 4 26	B 5 39	C 6 39	B 8 06	C 9 15
83	Naugatuck	C 8 47	C 11 32	C 1 39	C 4 33	B 5 51	C 6 46	B 8 18	C 9 22
88	Waterbury	C 8 58	C 11 44	C 1 51	C 4 45	B 6 03	C 6 58	B 8 30	C 9 34
		AM	AM	PM	PM	PM	PM	PM	AM

NEW YORK - WATERBURY

WEEKDAY SCHEDULE EFFECTIVE: 7/10/2022

TO NEW YORK	AM PEAK					OFF-PEAK						
	1911	1925	1937	1951	1957	1965	1973	1979	1987	1991	1995	1997
Waterbury	4:43 AM	5:38 AM	6:36 AM	8:41 AM	10:43 AM	12:40 PM	2:22 PM	3:57 PM	5:53 PM	6:57 PM	8:01 PM	9:58 PM
Naugatuck	4:52 AM	5:47 AM	6:45 AM	8:50 AM	10:52 AM	12:49 PM	2:31 PM	4:06 PM	6:02 PM	7:06 PM	8:10 PM	10:07 PM
Beacon Falls	4:59 AM	5:54 AM	6:52 AM	8:57 AM	10:59 AM	12:56 PM	2:38 PM	4:13 PM	6:09 PM	7:13 PM	8:17 PM	10:14 PM
Seymour	5:04 AM	5:59 AM	6:57 AM	9:02 AM	11:04 AM	1:01 PM	2:51 PM	4:18 PM	6:20 PM	7:25 PM	8:22 PM	10:19 PM
Ansonia	5:11 AM	6:06 AM	7:04 AM	9:09 AM	11:11 AM	1:08 PM	2:58 PM	4:25 PM	6:27 PM	7:32 PM	8:29 PM	10:26 PM
Derby-Shelton	5:14 AM	6:09 AM	7:07 AM	9:12 AM	11:14 AM	1:17 PM	3:01 PM	4:33 PM	6:30 PM	7:35 PM	8:32 PM	10:29 PM
Bridgeport	5:40 AM	6:36 AM	7:33 AM	9:38 AM	11:40 AM	1:41 PM	3:27 PM	4:59 PM	6:55 PM	8:00 PM	9:00 PM	10:54 PM

TO WATERBURY	AM OFF-PEAK	AM Peak	OFF-PEAK				PM PEAK			PM OFF-PEAK
	1902	1910	1916	1922	1928	1938	1942	1954	1974	1990
Bridgeport	7:02 AM	8:39 AM	10:43 AM	12:50 PM	2:06 PM	4:06 PM	5:35 PM	6:40 PM	8:31 PM	11:50 PM
Derby-Shelton	7:31 AM	9:05 AM	11:09 AM	1:14 PM	2:30 PM	4:30 PM	5:59 PM	7:04 PM	8:59 PM	12:14 AM
Ansonia	7:35 AM	9:15 AM	11:17 AM	1:18 PM	2:34 PM	4:34 PM	6:03 PM	7:08 PM	9:03 PM	12:18 AM
Seymour	7:42 AM	9:22 AM	11:24 AM	1:25 PM	2:41 PM	4:41 PM	6:10 PM	7:15 PM	9:10 PM	12:25 AM
Beacon Falls	7:57 AM	9:28 AM	11:30 AM	1:31 PM	2:47 PM	4:47 PM	6:16 PM	7:21 PM	9:16 PM	12:31 AM
Naugatuck	8:04 AM	9:35 AM	11:37 AM	1:38 PM	2:54 PM	4:54 PM	6:23 PM	7:28 PM	9:23 PM	12:38 AM
Waterbury	8:17 AM	9:48 AM	11:50 AM	1:51 PM	3:07 PM	5:07 PM	6:36 PM	7:41 PM	9:36 PM	12:56 AM

Reflects the planned July 2022 Waterbury Train Schedule implementation.

Appendix D - Rail Service Equity Analysis 2021 and 2022 Train Schedules

Hartford Line

Table D1 - 2019 Ridership Survey Hartford Line Fare Medium Use (Full Table)

Fare Medium	All Passengers Total	All Passengers %	All Passengers (Minority)	All Passengers (Low-income)	Minority Count	Minority %	Low-income Count	Low- income %
Ten-trip Ticket	61	5.43%	51	47	16	31.4%	0	0.0%
Monthly Pass	139	13.09%	123	116	39	31.7%	12	10.3%
One Way Discount Ticket senior/disabled	70	6.38%	60	57	18	30.0%	17	29.8%
One-Way	796	72.98%	686	598	318	46.4%	162	27.1%
10 Discount Ticket senior/disabled	14	1.17%	11	7	3	27.3%	0	0.0%
Weekly Ticket	10	0.96%	9	9	2	22.2%	5	55.6%
Total	1,090		940	834	396		196	

Table D2 - Estimated 2021 Hartford Line Fare Medium Usage by Classification (Full Table)

Fare Medium	All Purchases	% All Purchases	Minority Estimate	% Minority	Low-income Estimate	% Low-income
Ten-trip Ticket	690	0.5%	216	31.4%	0	0.0%
Monthly	349	0.3%	111	31.7%	36	10.3%
One Way Senior/Disabled	32,250	23.7%	9,675	30.0%	9,618	29.8%
One Way	102,135	75.2%	47,345	46.4%	27,669	27.1%
Ten-trip Senior/Disabled	164	0.1%	45	27.3%	0	0.0%
Weekly	250	0.2%	56	22.2%	139	55.6%
Grand Total	135,838		57,448		37,462	

Table D3 - Annual Hartford Line Fare Expenses by Medium by Classification (Pre-20% Discount) (Full Table)

Fare Medium	Avg Fare Per Ticket	Total Fare Paid All Users	Total Fare Paid Minority	Total Fare Paid Low-income
Ten-trip Ticket	\$58.43	\$40,313	\$12,647.29	\$0.00
Monthly	\$117.97	\$41,171	\$13,054.06	\$4,259.02
One Way Senior/Disabled	\$3.61	\$116,263	\$34,878.98	\$34,675.00
One Way	\$6.97	\$712,138	\$330,116.45	\$192,920.33
Ten-trip Senior/Disabled	\$32.41	\$5,315	\$1,449.55	\$0.00
Weekly	\$36.38	\$9,094	\$2,020.83	\$5,052.08
Grand Total		\$924,293.75	\$394,167.16	\$236,906.43

Table D4 - Average Hartford Line Fare by Class (Pre-20% Discount) (Full Table)

	All	Minority	Low-income
Total Fares Paid	\$924,293.75	\$394,167	\$236,906.43
Total Count of Fares Paid	135,838	57,448	37,462
Average Fare Paid	\$6.80	\$6.86	\$6.32

Table D5 - Current Hartford Line Fare Expenses

	Total Fare Purchases	Total Price	Average
Ten-trip	690	\$40,313	\$58.43
Monthly	349	\$41,171	\$117.97
One Way SR/Disabled	32,250	\$116,263	\$3.61
One Way	102,135	\$712,138	\$6.97
Ten Trip Senior/Disabled	164	\$5,315	\$32.41
Weekly	250	\$9,094	\$36.38

Table D6 - Hartford Line Adjusted Fares for 20% Discount

	Total Fares Purchased	Total Price Paid	Original Price	New Fares
Ten-trip	690	\$40,313	\$44,793	\$35,834
Monthly	349	\$41,171	\$41,171	\$41,171
One Way SR/Disabled	32,250	116263.25	\$116,263.25	\$116,263
One Way	102,135	\$712,138.00	\$712,138.00	\$712,138
Ten Trip Senior/Disabled	164	\$5,315	\$5,315	\$5,315
Weekly	250	\$9,093.75	\$9,093.75	\$9,094
Total	135,838	\$924,294	\$928,773	\$919,815

Table D7 - Annual Hartford Line Fare Expenses by Medium by Class (Post-20% Discount) (Full Table)

Fare Medium	Avg Fare Per Ticket	Total Fare Paid All Users	Total Fare Paid Minority	Total Fare Paid Low-income
Ten-trip Ticket	\$51.93	\$35,834	\$11,242.04	\$0.00
Monthly	\$117.97	\$41,171	\$13,054.06	\$4,259.02
One Way Senior/Disabled	\$3.61	\$116,263	\$34,878.98	\$34,675.00
One Way	\$6.97	\$712,138	\$330,116.45	\$192,920.33
Ten-trip Senior/Disabled	\$32.41	\$5,315	\$1,449.55	\$0.00
Weekly	\$36.38	\$9,094	\$2,020.83	\$5,052.08
Grand Total		\$919,814.50	\$392,761.90	\$236,906.43

Table D8 - Average Hartford Line Fare by Class (Post-20% Discount) (Full Table)

	All	Minority	Low-income
Total Fares Paid	\$919,814.50	\$392,762	\$236,906.43
Total Count of Fares Paid	135,838	57,448	37,462
Average Fare Paid	\$6.77	\$6.84	\$6.32

Table D9 - Hartford Line Percent Change (Full Table)

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$6.80	\$6.86	\$6.32
Average Fare After 20% Discount	\$6.77	\$6.84	\$6.32
Percent Change	-0.5%	-0.4%	0.0%

Shore Line East

Table D10 - 2019 Ridership Survey Shore Line East Fare Medium Use (Full Table)

Fare Medium	All Passengers Total	All Passengers %	All Passengers (Minority)	All Passengers (Low- income)	Minority Count	Minority %	Low- income Count	Low- income %
Monthly pass (does not include New Haven Commuter Connection bus service)	154	26.4%	137	114	18	13.1%	4	3.5%
Monthly Plus (includes New Haven Commuter Connection bus service)	32	5.5%	28	23	2	7.1%	1	4.3%
Shore Line East Ten-trip ticket	53	9.1%	46	38	5	10.9%	5	13.2%
Shore Line East regular ticket	228	39.0%	198	173	43	21.7%	40	23.1%
Shore Line East senior/disabled Ten-trip ticket	15	2.6%	14	13	2	14.3%	1	7.7%
Shore Line East senior/disabled one-way ticket	58	9.9%	49	38	6	12.2%	5	13.2%
UniRail monthly (combined Shore Line East/New Haven Line monthly ticket)	38	6.5%	34	26	3	8.8%	1	3.8%
UniRail one-way ticket (combined Shore Line East/New Haven Line ticket)	6	1.0%	6	6	2	33.3%	1	16.7%
Total	584		512	431	81		58	

Table D11 - Estimated 2021 Shore Line East Fare Medium Usage by Classification (Full Table)

Fare Medium	All Purchases	% All Purchases	Minority Estimate	% Minority	Low-income Estimate	% Low-income
Monthly pass (does not include New Haven Commuter Connection bus service)	624	1.0%	82	13.1%	22	3.5%
Monthly Plus (includes New Haven Commuter Connection bus service)	40	0.1%	3	7.1%	2	4.3%
Ten-trip ticket	811	1.3%	88	10.9%	107	13.2%
One way	49,282	76.6%	10,703	21.7%	11,395	23.1%
Senior/disabled Ten-trip ticket	329	0.5%	47	14.3%	25	7.7%
Senior/disabled One way	13,215	20.5%	1,618	12.2%	1,739	13.2%
UniRail Monthly Pass	50	0.1%	4	8.8%	2	3.8%
Total	64,351		12,545		13,291	

Table D12 - Annual Shore Line East Fare Expenses by Medium by Classification (Pre-20% Discount) (Full Table)

Fare Medium	Avg Fare Per Trip	Total Fare Paid - All Users	Total Fare Paid - Minority	Total Fare Paid - Low-income
Monthly pass (does not include New Haven Commuter Connection bus service)	\$109.01	\$68,023.45	\$8,937.39	\$2,386.79
Monthly Plus (includes New Haven Commuter Connection bus service)	\$164.95	\$6,598.08	\$471.29	\$286.87
Ten-trip ticket	\$48.28	\$39,156.09	\$4,256.10	\$5,152.12
One way	\$8.93	\$440,118.34	\$95,581.26	\$101,761.47
Senior/disabled Ten-trip ticket	\$13.67	\$4,498.00	\$642.57	\$346.00
Senior/disabled One way	\$4.41	\$58,243.74	\$7,131.89	\$7,663.65
UniRail Monthly Pass	\$152.40	7620.16129	\$672.37	\$293.08
Grand Total		\$624,257.87	\$117,692.86	\$117,889.98

Table D13 - Average Shore Line East Fare by Class (Pre-20% Discount) (Full Table)

	All	Minority	Low-income
Total Fares Paid	\$624,257.87	\$117,693	\$117,889.98
Total Count of Fares Paid	64,351	12,545	13,291
Average Fare Paid	\$9.70	\$9.38	\$8.87

Table D14 - Current Shore Line East Fare Expenses

Fare Medium	Train Line	Count of ProductName	Fare Amount	Avg Per-Trip Fare
Monthly pass (does not include New Haven Commuter Connection bus service)	SLE	624	\$68,023.45	\$109.01
Monthly Plus (includes New Haven Commuter Connection bus service)	SLE	40	\$6,598.08	\$164.95
10-trip ticket	SLE	811	\$39,156.09	\$48.28
One way	SLE	49,282	\$440,118.34	\$8.93
Senior/disabled 10-trip ticket	SLE	329	\$4,498.00	\$13.67
Senior/disabled One way	SLE	13,215	\$58,243.74	\$4.41
UniRail - Monthly	SLE	50	7620.16129	\$152.40
Sum		64,351	\$624,257.87	\$9.70

Table D15 - Shore Line East Adjusted Fares for 20% Discount

Fare Medium	Train Line	Count of ProductName	10 % Price	Original Price	New Fares	Avg - New
Monthly pass (does not include New Haven Commuter Connection bus service)	SLE	624	\$68,023.45	\$68,023.45	\$68,023.45	\$109.01
Monthly Plus (includes New Haven Commuter Connection bus service)	SLE	40	\$6,598.08	\$6,598.08	\$6,598.08	\$164.95
10-trip ticket	SLE	811	\$39,156.09	\$43,506.77	\$34,805.42	\$42.92
One way	SLE	49,282	\$440,118.34	\$440,118.34	\$440,118.34	\$8.93
Senior/disabled 10-trip ticket	SLE	329	\$4,498.00	\$4,498.00	\$4,498.00	\$13.67
Senior/disabled One way	SLE	13,215	\$58,243.74	\$58,243.74	\$58,243.74	\$4.41
UniRail - Monthly	SLE	50	7620.16129	7620.16129	7620.16129	\$152.40
Sum		64,351	\$624,257.87	\$628,608.54	\$619,907.19	\$9.63

Table D16 - Annual Shore Line East Fare Expenses by Medium by Class (Post-20% Discount) (Full Table)

Fare Medium	Avg Fare Per Trip	Total Fare Paid - All Users	Total Fare Paid - Minority	Total Fare Paid - Low-income
Monthly pass (does not include New Haven Commuter Connection bus service)	\$109.01	\$68,023.45	\$8,937.39	\$2,386.79
Monthly Plus (includes New Haven Commuter Connection bus service)	\$164.95	\$6,598.08	\$471.29	\$286.87
Ten-trip ticket	\$42.92	\$34,805.42	\$3,783.20	\$4,579.66
One way	\$8.93	\$440,118.34	\$95,581.26	\$101,761.47
Senior/disabled Ten-trip ticket	\$13.67	\$4,498.00	\$642.57	\$346.00
Senior/disabled One way	\$4.41	\$58,243.74	\$7,131.89	\$7,663.65
UniRail Monthly Pass	\$152.40	\$7,620.16	\$672.37	\$293.08
		\$612,287.03	\$116,547.59	\$117,024.44

Table D17 - Average Shore Line East Fare by Class (Post-20% Discount) (Full Table)

	All	Minority	Low-income
Total Fares Paid	\$612,287.03	\$116,547.59	\$117,024.44
Total Count of Fares Paid	64,351	12,545	13,291
Average Fare Paid	\$9.51	\$9.29	\$8.80

Table D18 - Shore Line East Percent Change by User (Full Table)

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$9.70	\$9.38	\$8.87
Average Fare Post-20% Discount	\$9.51	\$9.29	\$8.80
Percent Change	-1.9%	-1.0%	-0.7%

Full Package

Table D19 - Percent Change in Full Package Payments (Full Table)

	All	Minority	Low-income
Average Fare Pre-20% Discount	\$7.74	\$7.31	\$6.99
Average Fare Post-20% Discount	\$7.65	\$7.28	\$6.97
Percent Change	-1.1%	-0.5%	-0.2%

Appendix E - Bus Major Service Change Threshold Analysis Results

The threshold analysis results for any proposed change that exceeded the major service change threshold are presented in this appendix.

Route 24

Threshold Analysis Results

The proposed route change would result in a Major Service Change under the Annual Revenue Vehicle Miles criterion (25% or more change).

Bradley - Union Connector

Threshold Analysis Results

The proposed route change would result in a Major Service Change under the Route Restructuring criterion (at least a 20% change in route length), change in Annual Revenue Vehicle Miles criterion (25% or more change) and Span of Service criterion (a change in the service span of at least one-hour).

Route 512

Threshold Analysis Results

No major service change thresholds were exceeded.

Route 940

Threshold Analysis Results

The proposed route change would result in a Major Service Change under the Route Restructuring criterion (at least a 20% change in route length), change in Annual Revenue Vehicle Miles criterion (25% or more change) and Span of Service criterion (a change in the service span of at least one-hour).

Route 282

Threshold Analysis Results

The proposed route change would result in a Major Service Change under the Route Restructuring criterion (at least a 20% change in route length), change in Annual Revenue Vehicle Miles criterion (25% or more change) and Span of Service criterion (a change in the service span of at least one-hour).

The following table summarizes the results of the Major Service Change Threshold Analysis.

Table E1: Major Service Change Threshold Analysis Results

Route	Major Service Change Criteria			
	Route restructuring actions resulting in at least a 20% change in overall route length	Service frequency changes that result in a 25% or more change in annual revenue vehicle miles (RVM). Annual RVMs are a compilation of weekday and weekend RVMs	A service change adding or reducing service to a fixed guideway station resulting in a greater than 25% change in service at the station	Service change actions resulting in at least a one-hour change in service span
24	NO	YES	NO	NO (+7 mins)
Bradley – Union Connector	YES (+100%)	YES (+100%)	NO	YES (New Service)
512	NO (+3%)	NO (+21%)	NO	NO (-5 mins)
940	YES (+100%)	YES (+100%)	NO	YES (New Service)
282	YES (+100%)	YES (+100%)	NO	YES (New Service)